SCHOOL ENGAGEMENT OF RURAL EARLY ADOLESCENTS: EXAMINING THE ROLE OF ACADEMIC RELEVANCE AND OPTIMISM ACROSS RACIAL/ETHNIC GROUPS

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ABSTRACT

Kristina Charles Webber: School Engagement of Rural Early Adolescents: Examining the Role of Academic Relevance and Optimism across Racial/Ethnic Groups
(Under the direction of Natasha K. Bowen)

School engagement is a robust predictor of academic achievement and school completion, as well as numerous social, emotional, and health outcomes in adolescence and adulthood. Given the accumulation of findings that illustrate the importance of school engagement for adolescents' short- and long-term outcomes, new research is needed to better understand what motivates students to become and stay engaged in school. Using data from two waves of the North Carolina Rural Adaptation Project, the current study contributes to the knowledge base by examining how holding a positive future orientation (i.e., optimism) and perceiving school as personally relevant each contribute to engagement.

Data from a sample of 2,063 racially/ethnically diverse rural early adolescents were analyzed to: (a) determine whether optimism, relevance, and engagement scales from the School Success Profile operate equivalently across four racial/ethnic groups; and (b) test hypothesized relationships between academic relevance, optimism, and engagement, and determine whether these relationships differ across youth from the four racial/ethnic groups. Results from multiple group confirmatory factor analysis indicated that each of the three scales demonstrated sufficient measurement invariance to permit cross-group comparisons on the constructs. Cross-group comparisons indicated significant mean-level differences in engagement, relevance, and optimism across racial/ethnic groups. Multiple group structural equation modeling was used to test a theoretically-informed conceptual model that hypothesized a series of direct and indirect

relationships between teachers' use of relevance strategies, students' future-oriented optimism, and school engagement. As a whole, the hypothesized model fit the data well and explained 34% of the variance in school engagement. Tests of potential moderation by race/ethnicity found that the overall explanatory value of the model was not significantly different across groups. However, many of the research questions related to the conceptual model did not bear out, specifically regarding the hypothesized predictors of school engagement and the hypothesized mediation relationships. The study found that teachers' use of relevance strategies did not directly influence students' engagement in school. Although teachers' use of relevance strategies positively influenced students' future-oriented optimism, this increased optimism did not translate into differences in school engagement.

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CHAPTER I
INTRODUCTION

School engagement, a valuable educational outcome in its own right, is a robust predictor of academic achievement and school completion, as well as numerous social, emotional, and health outcomes in adolescence and adulthood. Engagement in school is positively associated with various indicators of success in school, including academic performance and high school graduation (Bond et al., 2007; Fredricks, Blumenfeld, & Paris, 2004; Li & Lerner, 2011; Wang & Holcombe, 2010). Beyond the academic realm, school engagement is also associated with lower likelihood of emotional distress, substance use, early sexual activity, delinquent activity, and violence (Anderman, 2002; Bond et al., 2007; Brookmeyer, Fanti, & Henrich, 2006; Carter, McGee, Taylor, & Williams, 2007; Li & Lerner, 2011; Ross, Shochet, & Bellair, 2010).

Given the accumulation of findings that illustrate the importance of school engagement for adolescents' short- and long-term outcomes, new research is needed to better understand what motivates students to become and stay engaged in school. Motivation theory and a growing body of empirical literature suggest that holding a positive future orientation (i.e., optimism) and perceiving school as personally relevant each contribute to engagement. However, the nature of the relationships between these variables is not yet clear. For example, prior research indicates that teachers' use of relevance strategies is associated with increased student engagement (Orthner, Jones-Sanpei, Akos, & Rose, 2013), but there is a paucity of research that helps explain the mechanism though which this relationship may be operating. The current literature is further

hampered by methodological limitations. For example, there is a dearth of literature that focuses on rural schools (Gándara, Gutiérrez, & O'Hara, 2001), particularly with attention to the engagement of racially/ethnically diverse early adolescents.

Research Aims

The overarching purpose of the current study is to contribute to the knowledge base about the school engagement of early adolescents. More specifically, this study examines how early adolescents' perceptions of their educational experience and their views of the future may influence their engagement in school, with a specific focus on rural racial/ethnic minority early adolescents. This study has two primary aims: (a) examine the quality of data collected using scales related to academic relevance, optimism, and engagement, and determine whether these scales operate equivalently across middle school students from four racial/ethnic groups of rural early adolescents; and (b) test hypothesized relationships between academic relevance, optimism, and engagement, and determine whether these relationships differ across middle school students from the four racial/ethnic groups.

The data source for this dissertation is the North Carolina Academic Center for Excellence Rural Adaptation Project (RAP), a 5-year longitudinal panel study of more than 5,000 middle-school students from 28 public schools in two rural, economically disadvantaged counties in North Carolina. This dissertation uses RAP data from Waves 1 and 2. The RAP dataset is unique in that it provides data on an entirely rural sample that includes youth from four major racial/ethnic groups: African American, Caucasian, Hispanic/Latino and Native American. The presence of a substantial number of Native American youth in the sample is especially rare. Most studies related to the educational experiences of youth do not include Native American participants in any substantial way. The dataset also includes specific questions about school

engagement, academic relevance, and future optimism. Therefore, these data makes it possible to examine relationships among these variables among a diverse group of rural early adolescents.

The analytic approach used in this study is structural equation modeling (SEM). More specifically, multiple group confirmatory factor analysis was used to examine quality of data gathered with the items and whether these items performed equivalently for students from different racial/ethnic groups (Study Aim 1). Multiple group structural equation modeling was used to test the hypothesized structural relationships among the variables of interest and whether these relationships varied for students from different racial/ethnic groups (Study Aim 2). These methods were selected for several reasons. First, the SEM approach allowed for modeling of latent factors and simultaneous testing of the direct and indirect relationships among the variables of interest. The ability to test simultaneous equations instead of models with only one dependent variable (as in multiple regression) is a strength of SEM (Hoyle, 2012). Second, the Weighted Least Squares Means and Variances adjusted (WLSMV) method used is a robust estimator capable of providing accurate estimates and standard errors when modeling ordinal, non-normally distributed data such as that found in the current study (Flora & Curran, 2004). Third, SEM provided a framework for conducting tests of measurement invariance and testing a conceptual model that hypothesized mediational relationships moderated by group membership (i.e., moderated mediation).

Overview of Dissertation

The remainder of this dissertation follows in four chapters. Chapter 2 provides a description of school engagement and the problem of school disengagement, including prevalence rates and implications for youth outcomes. Next, the theoretical underpinnings of the current study are presented, followed by a review of empirical literature illustrating the current

knowledge regarding the relationships between relevance, optimism, and engagement. The conceptual model to be tested in the study is presented, along with specific aims and research questions. Chapter 3 details the methods employed to answer the research questions. Study design, sample, measurement, and data analysis procedures are described. Chapter 4 presents the results of the confirmatory and structural equation modeling analyses. Chapter 5 concludes the dissertation and provides a discussion of the strengths and limitations of the study, implications for the social work and education fields, and directions for future research.

CHAPTER II
BACKGROUND AND SIGNIFICANCE

This chapter first describes school engagement and the problem of disengagement, including prevalence estimates and the implications of disengagement for youth's developmental outcomes. Next, two theories of motivation are reviewed as a framework for understanding why students engage or disengage from school. The conceptual model for the current study is then described, followed by a review of the empirical research on the relationships between optimism, academic relevance, and school engagement depicted in the conceptual model. Next, conceptual and methodological limitations of the existing literature are identified. The chapter ends with a set of specific aims and research questions addressed in this dissertation.

School Engagement Defined

School engagement can be understood as the extent to which students are actively committed to and invested in the everyday academic and social aspects of the educational process. Although numerous definitions and models of school engagement are apparent in the literature, most sources conceptualize engagement as a multidimensional meta-construct encompassing three distinct components: behavioral engagement, cognitive engagement, and psychological/emotional engagement (Appleton, Christenson, & Furlong, 2008; Fredricks et al., 2004). Behavioral engagement draws on the idea of participation (Finn, 1989) and includes attendance, participation in class and extracurricular activities, and compliance with school norms and rules (Appleton et al., 2008; Fredricks et al., 2004). Cognitive engagement draws on the idea of investment in learning and includes use of meta-cognitive learning strategies and self-

regulation (Fredricks et al., 2004). Emotional engagement encompasses affective aspects, including positive and negative feelings or attitudes regarding the schooling experience, identification with school, satisfaction with school, and feelings of belonging (Appleton et al., 2008; Osterman, 2000). Of the three components, the behavioral and emotional aspects of engagement have received the most attention in both theoretical and empirical research.

Prevalence of School Engagement and Disengagement

Student disengagement is an issue that affects all schools, regardless of grade level (e.g., elementary, middle, or high school), student characteristics (e.g., race/ethnicity, SES) or geographic location (e.g., rural, suburban, urban) (National Research Council and the Institute of Medicine [NRCIM], 2004; Yazzie-Mintz, 2010). However, precise prevalence rates for student engagement or disengagement in school are difficult to ascertain. Definitions and measures of student engagement are not uniformly applied or reported across national samples. The National Research Council and Institute of Medicine (NRCIM; 2004) estimates 30% to 50% of middle school students are disengaged from school. Other sources, such as the High School Survey of Student Engagement (Yazzie-Mintz, 2007; 2010) and the Organization for Economic Cooperation and Development's Program for International Student Assessment (PISA; Willms, 2003) report estimates from 17% (Willms, 2003) to 60% (Yazzie-Mintz, 2007). These estimates are based on surveys of students who were in school at the time of the study, and therefore are likely to underestimate prevalence of disengagement. Students who are chronically absent or students who have dropped out of school are unlikely to be captured in these estimates.

Estimated prevalence rates also vary across demographic groups. On average, male students, students living in poverty, and students with a history of school failure (e.g., students who have repeated a grade) report greater disengagement than their peers (Marks, 2000; Woolley

& Bowen, 2007; Yazzie-Mintz, 2007; 2010). With respect to racial and ethnic differences, some studies have found that racial/ethnic minority youth report higher levels of engagement than Caucasian students (Johnson, Crosnoe, & Elder, 2001; Shernoff & Schmidt, 2008), while other studies have found that racial/ethnic minority youth report lower levels of engagement than their Caucasian peers (Woolley & Bowen, 2007; Yazzie-Mintz, 2007; 2010). Yet other studies have found no racial/ethnic difference in engagement (Johnson et al., 2001; Marks, 2000). Lack of specificity regarding the aspect of engagement measured (e.g., behavioral engagement versus a general or composite engagement measure) may contribute to these inconsistent findings. For example, a recent study of middle school students found that African American students reported higher emotional engagement, but lower behavioral engagement than Caucasian students (Wang, Willett, & Eccles, 2011). Another potential explanation is that the instruments used to measure engagement may not perform equivalently with students from different racial/ethnic groups, and may in fact, be measuring different constructs. As such, additional research is needed to further investigate possible racial/ethnic differences in engagement.

Cross-sectional studies and a limited number of longitudinal studies suggest that levels of engagement change across the educational career. Although there is some evidence that engagement may rebound during late high school (Witherspoon & Ennett, 2011), most studies have found that engagement generally declines during middle school (Janosz, Archambault, Morizot, & Pagani, 2008; Marks, 2000; NRCIM, 2004). Cross-sectional (Perry & McIntire, 2001) and longitudinal (Witherspoon & Ennett, 2011) studies using rural samples report a continuous decrease in engagement from 6th to 10th grade. The decline appears to be steeper for students in low-performing, high-poverty schools (Yazzie-Mintz, 2007).

Implications of School Engagement for Youth Outcomes

A substantial body of research suggests that the extent to which students are actively engaged in the academic and social aspects of school has significant implications for their academic outcomes and overall well-being (Fredricks et al., 2004; Li & Lerner, 2011; Osterman, 2000; Resnick et al., 1997). Engagement in school is positively associated with academic performance and high school graduation (Bond et al., 2007; Fredricks et al., 2004; Li & Lerner, 2011; Wang & Holcombe, 2010). For example, among a sample of rural African American students, higher psychological/emotional engagement in middle school predicted higher end-of-year grades in ninth grade (Irvin, 2012). Results from a longitudinal study of 13,300 French-Canadian students suggests that students who report low levels of engagement in early adolescence or who experience unstable engagement trajectories were more likely to drop out (Janosz et al., 2008).

Although school engagement is most commonly examined in relation to academic achievement, its role as a protective factor for other youth development outcomes has also been established (Catalano, Haggerty, Oesterle, Fleming, & Hawkins, 2004). In one of the most comprehensive studies available, Resnick et al. (1997) examined the relationships between engagement and health risk behaviors using cross-sectional data from the National Longitudinal Study of Adolescent Health (i.e., AddHealth). Among this sample of students in grades 7 through 12, school connectedness (an aspect of emotional engagement) was protective against seven of the eight risk behaviors assessed, including: emotional distress, suicidal thoughts and behaviors, violence, substance use (specifically cigarettes, alcohol, and marijuana), and early sexual activity. These findings are supported by other studies, which have found that school engagement is associated with a lower likelihood of engaging in delinquency (e.g., stealing,

vandalism), violence (e.g., physical fights), or negative health behaviors (e.g., sexual activity, substance use), and fewer symptoms of emotional distress (e.g., anxiety, depression, suicidal ideation) (Anderman, 2002; Bond et al., 2007; Brookmeyer et al., 2006; Carter et al., 2007; Li & Lerner, 2011; Ross et al., 2010).

Overall, the empirical evidence indicates that school engagement is clearly an important protective factor in general and a powerful predictor of educational and developmental outcomes (Anderman, 2002; Irvin, 2012; Klem & Connell, 2004; Resnick et al., 1997). However, school engagement is especially important during early adolescence (i.e., middle school), because these years are a particularly precarious time in terms of changes in students' school-related beliefs and behaviors (Eccles et al., 1993; Ryan & Patrick, 2001). For some early adolescents, the middle school years lead to new academic interests, increased self-regulated learning, and a deepening commitment to education (Goodenow, 1993). For some students, however, the middle school years mark the beginning of declining interest, engagement, and performance in school (Balfanz, Herzog, & Mac Iver, 2007; Eccles et al., 1993; Witherspoon & Ennett, 2011). As mentioned earlier, early signs of disengagement and declining trajectories of engagement are not uncommon during this time period (Janosz et al., 2008; Marks, 2000; NRCIM, 2004).

The middle school years (i.e., early adolescence) are also a time when long-term educational and occupational trajectories are tentatively established (Beal & Crockett, 2010; Bond et al., 2007; Sameroff, Peck, & Eccles, 2004). Disengagement during middle school is associated with concurrent poor academic performance (Wang & Holcombe, 2010), which in turn, is predictive of poor academic achievement in subsequent years and low educational attainment or dropping out of school (Balfanz et al., 2007; Jimerson, 2001; Rumberger, 2004). Individuals with low educational attainment are at higher risk of negative developmental

outcomes in adolescence and adulthood. Examples include poor peer relations, teenage pregnancy, poorer physical and mental health, homelessness, increased rates of alcohol and drug use, criminal or delinquent behavior, and incarceration (Amos, 2008; Cataldi, Laird, & KewalRamani, 2009; Englund, Egeland, Oliva, & Collins, 2008; Fothergill et al., 2008; Rouse, Brooks-Gunn, & McLanahan, 2005; Western, Schiraldi, & Ziedenberg, 2003).

Underachievement and school dropout also have long-term negative financial impacts on society. A high school dropout is more likely to earn low wages, face unemployment, rely on public assistance, and therefore contribute less in taxes than high school graduates (Adair, 2001). The economic impact of just one cohort of dropouts is estimated in the billions of dollars in lost revenues, underemployment, justice system cases, and welfare and public health care programs (Amos, 2008; Tucci, 2011).

School Engagement as a Target for Intervention

The extent and depth of a student's engagement in school is generally thought to be the result of dynamic transactions between the individual and the social context (Marks, 2000) and is therefore responsive to academic and social aspects of the classroom and school environments (Fredricks et al., 2004; Ryan & Patrick, 2001). In this respect, engagement is distinguished from factors that are highly predictive of school outcomes but are not malleable (e.g., race/ethnicity, socioeconomic status). Targeting aspects of the classroom environment (e.g., teacher behaviors, curriculum, climate) and understanding how students perceive these experiences may offer the possibility of positively influencing student engagement and in turn, other developmental outcomes (Goodenow, 1993). An investigation of the facilitators of engagement promises to help us better understand the complexity of students' school experiences and to design specifically targeted and nuanced interventions.

Theoretical Frameworks for Understanding School Engagement

As stated earlier, engagement is believed to result from dynamic transactions between the individual and the social context in which academic achievement is expected to occur (Marks, 2000). Few theories attempt to explain engagement in school directly (see Connell & Wellborn, 1990 and Tinto, 1997 for exceptions). Existing studies of school engagement often rely on theories of motivation, which can be applied in multiple fields but are frequently used in understanding achievement motivation in education settings. Accordingly, the current study is informed by two such theories of motivation: expectancy-value theory (Eccles et al., 1983; Eccles, 2009) and possible selves theory (Markus & Nurius, 1986). Although emerging from distinctly different historical streams of motivation theory, both theories offer explanations of why students engage in school.

Overall, expectancy-value theory asserts that engagement is most likely to occur when students personally value what is being taught because it has intrinsic, attainment, or utility value (or a combination of these attributes) and when they are optimistic about their chances of current or future success (Eccles, 2009; Schunk, Pintrich, & Meece, 2008). This premise implies that schools should seek to identify strategies that increase students' optimism and the perceived personal relevance of school. Possible selves theory asserts that: (a) individuals' beliefs about the future are powerful motivators for present behavior and (b) individuals' thoughts about their personal futures are shaped in part by information communicated by others (e.g., friends, parents, teachers, society) about what is possible (Markus & Nurius, 1986). Overall, possible selves theory posits that students' motivation to engage in school is related to how vividly they can picture different possible selves (i.e., futures), how closely they identify with these possible selves, and the connections students perceive between school and achieving their desired futures.

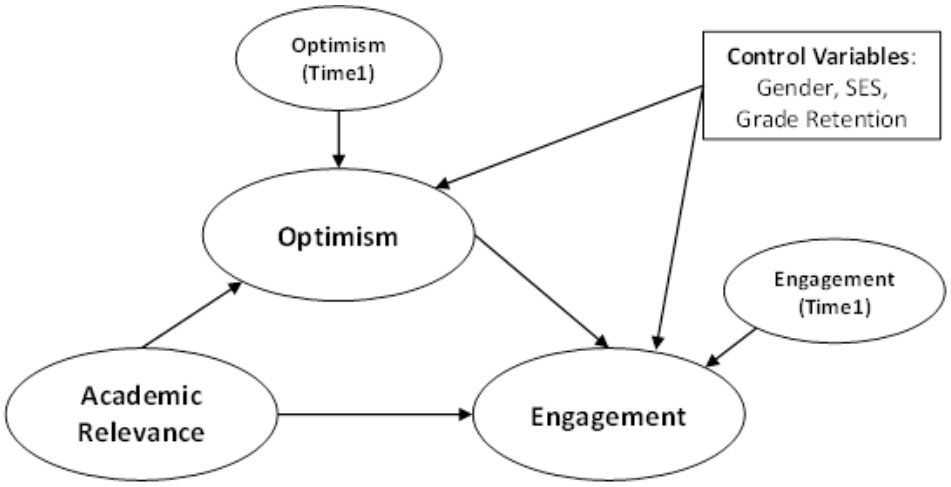
Together, expectancy-value and possible selves theories highlight the importance of students' perceptions of school as personally relevant, students' beliefs about their futures and their chances of success, and the potential role of significant others (e.g., teachers) in shaping students' perceptions. A growing number of empirical studies also supports the importance of these factors and suggests that academic relevance and positive future orientation may play important roles in influencing school engagement. However, more research is needed to explicate the nature of these relationships, particularly among diverse groups of early adolescents. Accordingly, the current study aims to address this gap. The following section presents the hypothesized model to be tested in this dissertation and the empirical literature that informs the model.

Conceptual Model

The conceptual model to be tested in the current study is depicted in Figure 1. Consistent with expectancy-value theory (Eccles et al., 1983) and possible selves theory (Markus & Nurius, 1986), school engagement is hypothesized to be directly influenced by both academic relevance (i.e., value; possible futures) and future-oriented optimism (i.e., expectancies for success). In this model, academic relevance is conceptualized as an exogenous variable that represents teachers' use of relevance-focused instructional strategies. Teachers' use of relevance strategies is also hypothesized to positively influence early adolescents' optimism. As illustrated by the pathway connecting academic relevance to engagement through optimism, the model posits optimism is a potential mechanism by which relevance-focused instructional strategies influence school engagement. Students' gender, socioeconomic status (SES), and history of previous grade retentions are included as control variables because these factors have been shown in previous

Figure 1.

Conceptual Model of Hypothesized Relationships Among Academic Relevance, Optimism, and School Engagement



studies to be predictive of school engagement (Li & Lerner, 2011; Woolley & Bowen, 2007) and optimism (Andretta, Worrell, Mello, Dixson, & Baik, 2013).

Relationships between Academic Relevance, Optimism, and School Engagement

This section reviews previous research related to the relationships hypothesized in the conceptual model and highlights the gaps and limitations of this literature. The chapter then concludes with the specific set of research questions that guides this dissertation.

Academic relevance. There have been calls for increased attention to relevance in K-12 education (Brophy, 2008; NRCIM, 2004) in terms of reforming curriculum content as well as identifying strategies to make the value and relevance of school more explicit to students. Students may perceive school as personally relevant for a variety of reasons. For example, they may find what they are learning to be interesting or enjoyable, they may feel that learning and achieving is personally important, or they may see school as instrumental to their future success (Eccles et al., 1983; Eccles, 2009; Hidi & Renninger, 2006). Each of these related, yet distinct, aspects of relevance plays a role in many theories of motivation, as well as in empirical investigations of students' academic motivation, engagement, and achievement.

Academic relevance and school engagement. The extent to which students' perceive school as personally relevant is positively associated with their motivation, engagement, and achievement (Andriessen, Phalet, & Lens, 2006; Assor, Kaplan, & Roth, 2002; Greene, Miller, Crowson, Duke, & Akey, 2004; McInerney &McInerney, 2000; Rose et al., in press; Shernoff, Csikszentmihalyi, Schneider, & Shernoff, 2003; Simons, Dewitte & Lens, 2004). Among a small sample of high school students, Crumpton and Gregory (2011) found that students who viewed the school curricula as relevant to their current or future lives reported higher levels of school engagement, controlling for engagement in the previous year. The authors found that perceived

relevance of school accounted for 15% of the variance in students' engagement. Likewise, in one of the few studies involving rural adolescents, the extent to which students perceived a specific class to be relevant to their future predicted their motivation and engagement in that class (Hardré, Crowson, Debacker, & White, 2007).

However, the value or relevance of what is being taught in schools is not always readily apparent. Concepts are often taught in isolation, disconnected from practical, real-world applications (Brophy, 2008; NRCIM, 2004). In a recent survey of high school students, 75% of students said they were bored in class because the material was not interesting; 40% reported feeling bored because the material was not relevant to their lives or their futures (Yazzie-Mintz, 2010). Lack of interest and a perceived lack of usefulness for the future are frequently cited as reasons for dropping out of school (Rumberger, 2004).

Students' perceptions of the value and relevance of school can be influenced by a number of factors, including aspects of the school context (e.g., Orthner et al., 2013; Oyserman, Terry, Bybee, 2002; Rose et al., in press). The instructional strategies used by teachers are one such aspect of the school context. In observational studies, teachers who are effective in fostering student appreciation for a subject area are more likely than other teachers to use specific relevance-focused instructional techniques, including making abstract content more concrete and personal, connecting content to student interests and home backgrounds, emphasizing applications to life outside of school, and connecting content to its application in career fields (Dolezal, Mohan Welsh, Pressley, & Vincent, 2003; Mac Iver, Young, & Washburn, 2002). Compared to qualitative classroom observation studies, however, studies that use quantitative methods to connect school engagement with use of relevance-focused instructional strategies are fewer in number. These studies also tend to focus on whole school reform efforts in high schools,

such as career academies or school-to-career initiatives (NRCIM, 2004), rather than classroom level instructional strategies. For instance, studies of reforms that emphasize authentic instructional work (i.e., class work that connects to student interests and real-world applications) suggest that such practices significantly contribute to engagement, especially for middle and high school students (Marks, 2000).

Although only a small number of cross-sectional studies and experimental evaluations focus specifically on teachers' use of relevance strategies, findings from these studies indicate that student engagement can be affected by such practices (Greene et al., 2004; Newby, 1991; Orthner et al., 2013). Among a predominately Caucasian, suburban sample of high school students, teachers' use of relevance strategies (e.g., connecting activities and assignments to students' interests, everyday lives, or future careers) was positively associated with students' perception of school as personally relevant which was, in turn, associated with student engagement (Greene et al., 2004). Likewise, in an experimental evaluation of the CareerStart intervention, middle school students whose teachers used examples connecting course content with specific careers reported significantly higher school engagement and valuing than students whose teachers did not use such examples (Orthner et al., 2013).

It is important to note that these relationships between engagement and relevance have been observed across studies using diverse conceptualizations and measures of relevance. In terms of conceptualization, for example, some studies examine students' perceptions of relevance (e.g., Crumpton & Gregory, 2011; Hardré et al., 2007), while others more specifically examine teachers' instructional practices related to relevance (e.g., Greene et al., 2004; Orthner et al., 2013). In terms of operationalization, measures vary in specificity. For example, relevance may be operationalized as a global construct, meaning that students are asked about their school

or their teachers *in general* (e.g., Crumpton & Gregory, 2011; Orthner et al., 2013), rather than about a specific domain or subject area (e.g., Greene et al., 2004; Hardré et al., 2007). Although the research on relevance is relatively scant, the consistency of findings despite measurement differences suggests the potential of relevance as a critical factor in influencing school engagement.

There are substantial limitations to the existing literature on relevance. Few studies focus on rural populations, middle school students, or racially and ethnically diverse students. In addition, the majority of studies have focused on cognitive or behavioral engagement; a smaller number of studies, predominately qualitative, have investigated the relationship between academic relevance and emotional engagement (Fine, 1991; McInerney & McInerney; 2000). Further, existing studies have not identified theoretically supported mechanisms or processes that would help explain why teachers' use of relevance strategies is associated with student engagement.

Future-oriented optimism. Time perspective is a social-cognitive construct that includes several dimensions, including time attitude – how individuals think and feel about the past, the present, and the future (Lewin, 1939; Trommsdorff, Lamm, & Schmidt, 1979). Attitudes about the future are especially relevant during the adolescent years given that early adolescents are developing the cognitive ability to consider hypothetical situations (Blakemore & Choudhury, 2006; Piaget, 1955) and are increasingly faced with developmental tasks that involve thinking about and planning for the future (Erikson, 1968). Early adolescents are making important choices (e.g., decisions about peer groups, risky behaviors, value of school) that shape their sense of identity and future life course. Despite some differences in the nomenclature, a growing body of literature suggests that variables related to a positive future-oriented attitude

(e.g., future orientation, hope, success orientation, sense of control/agency, optimism) are associated with positive developmental outcomes for adolescents (Snyder et al., 1997; Worrell & Hale, 2001). A positive future orientation may be especially important for students who may encounter structural barriers to success, such as barriers related to socioeconomic status or racial/ethnic minority group membership (McCabe & Barnett, 2000; Meece & Kurtz-Costes, 2001). The current study uses the terms optimism, future orientation, and future-oriented optimism interchangeably, all referring to an expectancy of positive future outcomes (Carver & Scheier, 1990). Given the importance of optimism during early adolescence, and its central role in this study's conceptual model, it is important to discuss briefly the nature of optimism before reviewing the research on the relationships between optimism, relevance, and engagement.

The nature of optimism. In the most common conceptualization, optimism is defined as positive expectations about future events (Carver & Scheier, 1990); these expectations may be general and globalized or more domain-specific (Carver, Scheier, & Segerstrom, 2010). Optimism is generally considered to be a relatively stable personality trait that is developed during childhood and adolescence through the influence of genetics, experiences with success and failure, and the modeling of parents, teachers, and other influential adults (Gillham & Reivich, 2004). This conceptualization suggests opportunities exist during adolescence for shaping the manner in which individuals think about their futures.

Further, there is some evidence that despite its conceptualization as a personality trait, optimism is somewhat malleable and responsive to interventions (Carver et al., 2010; Gillham, Shatte, Reivich, & Seligman, 2002; Meevissen, Peters & Alberts, 2011). For example, among a sample of adults ranging from 18 to 43 years of age, a visualization exercise in which participants imagined their best possible future self was associated with increased optimism as

compared to a control group (Meevissen et al., 2011). Among college and middle school students, interventions focused on outcomes as varied as depression (Gillham et al., 2002; Selingman, Schulman, & Tryon, 2007) and school connectedness (Oyserman et al., 2002) have found that increasing positive expectancies of the future was the mechanism by which the interventions operate. It is also important to note that both expectancy-value theory and possible selves theory conceptualize expectancies for future success (i.e., optimism) not as a fixed trait, but rather as a malleable state that is influenced by numerous social-environmental factors.

Together, these theoretical foundations and empirical findings suggest the appropriateness of investigating optimism as a malleable state. Accordingly, a recent meta-analysis of optimism and related constructs highlighted the need for research that studies state, rather than trait (i.e., dispositional) conceptualizations and examines the extent to which interventions can influence optimism (Alarcon, Bowling, & Khazon, 2013). With this background regarding the nature of optimism, the discussion now turns to the empirical literature regarding the relationships between optimism and the other constructs of interest in this study: school engagement and academic relevance.

Optimism and school engagement. The idea that perceptions of the future influence present behavior is not a new concept (Erikson, 1968; Nurmi, 1991; Trommsdorff et al., 1979). In the context of education, substantial evidence indicates that students' attitudes about the future are associated with their school engagement and subsequent academic outcomes. This association has been reported in studies with low-income rural and urban adolescents (Beal & Crockett, 2010; Worrell & Hale, 2001; Wyman, Cowen, Work, & Kerley, 1993). A small number of longitudinal studies provide an indication of the direction of the relationship between optimism and engagement. Wyman et al. (1993) found that middle school students in high-risk

neighborhoods who reported optimism about the future had higher engagement than their low-optimism peers two years later. Studies using samples of predominately Caucasian middle and high school students found that optimism predicted engagement one year later, even after controlling for initial engagement levels (Van Ryzin, 2011; Van Ryzin, Gravely, & Roseth, 2009). These researchers found no support for the reverse hypothesis--that engagement would predict optimism across the span of the year.

Optimism and academic relevance. Possible selves and expectancy value theories both posit that adolescents create and adjust their expectancies of the future based on experiences and interactions with influential others, including teachers. Based on these theories, it is reasonable to hypothesize that teaching practices conveying the impression that teachers are optimistic about students' futures would in turn positively influence students' own expectancies of their futures. However, the empirical literature in this area is limited and does not reflect consensus on the nature of this relationship. In a cross-sectional study with middle class Caucasian high school students, Greene and colleagues (2004) did not find a significant relationship between teachers' use of relevance strategies and students' self-efficacy – a construct that is distinct, yet conceptually related to optimism (Bandura, 1997; Gillham & Reivich, 2004). Conversely, studies with more diverse samples (e.g., adolescents in low-performing schools and low-income neighborhoods) have found that when students see connections between what they are learning in school and their future goals and career/work opportunities, they are more likely to have higher expectations for future success (Perry, 2008). Further empirical research is needed to understand these conflicting findings. Inconsistencies in study findings may result from differing conceptualizations and measures of relevance and optimism used by the researchers.

Alternatively, the findings may suggest that the relationship between academic relevance and optimism varies for different student groups.

Limitations and gaps in the existing literature. The current literature clearly indicates the importance of school engagement, and suggests that optimism and academic relevance are two promising areas of inquiry for better understanding and influencing school engagement. However, more research is needed to explicate the nature of these relationships. Specifically, prior research indicates that teachers' use of relevance strategies is associated with increased student engagement (Orthner et al., 2013), but there is a paucity of research that helps explain the mechanism though which this relationship may be operating. In addition, the nature of the relationship between academic relevance and optimism remains unclear, especially among racially/ethnically diverse students. The current study aims to address these gaps in the literature by examining these relationships among a diverse sample of early adolescents and testing a potential mechanism by which academic relevance influences engagement (i.e., optimism). Further, the study assesses whether the presence and significance of hypothesized relationships between relevance, optimism, and engagement hold across multiple racial/ethnic groups. The study will also address the following methodological gaps in the existing literature related to design, sample, measurement, and analysis.

Design. An abundance of cross-sectional studies appears in the literature; longitudinal studies primarily examine change in one variable (e.g., engagement) over time. Increased attention to both short-term and long-term longitudinal designs would contribute to a better understanding of the nature of the relationships between variables. The current study extends the existing literature by using a half-longitudinal design with two waves of data to test a mediational model (Cole & Maxwell, 2003).

Sample. There is a dearth of literature that focuses on rural schools (Gándara et al., 2001), particularly with attention to the engagement of early adolescents. Studies of school engagement and future orientation have been conducted primarily with non-rural Caucasian or African American samples (Fredricks et al., 2004). Further, few studies of rural students have used racially or ethnically diverse samples; American Indian early adolescents are particularly under-represented in the literature. The current study addresses this limitation through the use of a diverse sample of rural early adolescents that includes a substantial number of American Indian students.

Measurement. Prior research indicates that levels of school engagement and future-oriented optimism may differ by race/ethnicity (Li & Lerner, 2011; Woolley & Bowen, 2007; Witherspoon & Ennett, 2011). However, with few exceptions (see Wang et al., 2011), studies have not considered the implications of measurement invariance when making group comparisons. Measurement invariance generally refers to the extent to which the content of each item of a measure is being perceived and interpreted in the same way across groups (Byrne, 2012). If measures of the constructs of interest (e.g., optimism) operate differently across racial/ethnic groups and these variations are not taken into account, it is inappropriate to make comparisons across groups (Sass, 2011). If items do not measure the same construct or are not related to the construct in the same way, conclusions about group differences are ambiguous because apparent differences in group-level scores may instead reflect measurement differences (Cheung & Rensvold, 2002). The current study contributes to literature regarding the measurement of academic relevance, future orientation, and school engagement by rigorously testing for measurement invariance across four race/ethnic groups. Further, addressing measurement issues is a necessary prerequisite to meaningfully addressing substantive questions

regarding the relationships between academic relevance, future-oriented optimism, and school engagement, and whether the relationships vary among a diverse sample of rural early adolescents (i.e., structural invariance). Studies testing both measurement and structural invariance are scarce, but are needed in the literature (Sass, 2011).

Analysis. Despite common use of scales that are hypothesized to measure latent variables, many existing studies within the optimism and academic relevance literatures do not take advantage of latent variable analysis methods (e.g., structural equation modeling). Latent variable methods are more common, yet still underutilized, in the engagement literature. Among studies that use latent variable analyses, the most rigorous methods are not consistently applied. For example, ordinal non-normally distributed data (e.g., data obtained using Likert scales) are frequently modeled inappropriately as continuous normally distributed data. The current study employs the most current and rigorous methods to appropriately model and analyze the data.

Aims and Research Questions

The current study addresses the following specific aims and research questions:

Aim 1. Examine the quality of data collected using scales related to academic relevance, optimism, and school engagement. The following research questions related to this aim will be addressed:

1a. What is the underlying factor structure of data collected from a diverse sample of early adolescents using items related to *Academic Relevance*, *Success Orientation*, and *School Satisfaction* from the School Success Profile (SSP; Bowen & Richman, 2008) ?

1b. Does the measurement of the three constructs differ for early adolescents from different racial/ethnic groups?

Aim 2. Test the relationship between teachers' use of relevance strategies, students' future-oriented optimism, and school engagement, as illustrated in Figure 1. The following research questions related to this aim will be addressed:

2a. Are there latent mean differences in the three constructs across racial/ethnic groups?

2b. Does teachers' use of relevance strategies predict students' future-oriented optimism and school engagement?

2c. Does future-oriented optimism predict students' school engagement?

2d. Does future-oriented optimism mediate the relationship between teachers' use of relevance strategies and students' school engagement?

2e. Do the pathways between relevance strategies, optimism, and school engagement differ for students from different racial/ethnic groups?

CHAPTER III
METHODS

Data Source

Data in the current study come from the North Carolina Academic Center for Excellence Rural Adaptation Project (RAP), a 5-year longitudinal panel study of more than 5,000 middle-school students from 28 public schools in two rural, economically disadvantaged counties in North Carolina. Both counties have high poverty rates: 25 percent and 32 percent as compared to an average of 15% for the United States (U.S. Census, 2012). Median incomes are approximately $33,000 (U.S. Census, 2012). The RAP sample is unique in that it includes students from a majority-minority county that is home to one of the largest non-reservation concentrations of Native Americans (predominately Lumbee Indians).

The RAP sample includes approximately 60% of the middle school population across the two counties. In one of the counties, all students in grades 6 through 8 were approached for recruitment. Because the second county was both larger geographically and had a larger student population than the other county, a randomly-selected sample of approximately 40% of the middle school students was selected for recruitment. Students were followed annually as they moved through middle school (grades 6-8) and into high school over the five years of the project (2010-2015); new sixth grade students were added to the sample each year. Two waves of RAP data were available (Year 1, 2011, n=4,321; Year 2, 2012, n=4,532) at the time of the current study.

Data collection procedures. Participants completed an online survey each spring in their school's computer lab using individually-assigned identifiers and passwords. The 45-50 minute RAP survey consisted of items adopted from several established instruments, including the School Success Profile (Bowen & Richman, 2008), the Youth Self Report (Achenbach, 1991), the Conflict Behavior Questionnaire (Prinz, Foster, Kent, & O'Leary, 1979), and the Multigroup Ethnic Identity Measure Revised (Phinney & Ong, 2007). Trained data collection staff closely monitored survey administration. Participants received a $10 gift card for their participation in each data collection.

The RAP study protocol and assent/consent procedures were approved by the University of North Carolina at Chapel Hill Behavioral Sciences Institutional Review Board. Parental consent and student assent procedures differed across the two participating counties, in response to each district's administrative policies. In one county, the survey was conducted as a standard part of the school day; all students were approached for recruitment. In the second county, letters summarizing the study's purpose and procedures were sent to the parents/guardians of a randomly selected sample. In this county, all randomly-selected students were approached for recruitment unless the parent/guardian declined to permit a child's participation. In all cases, students provided online assent, after being provided information about the project's purpose, the voluntary nature of participation, the confidentiality of responses, and their rights as participants.

Participants

The initial dataset for the current study consisted of students who had data from both of the available RAP waves (N=3,240). Restricting the analytic sample to only those students with two waves of data accomplished two goals: a) reduced the number of students with missing data (e.g., students new to the project in Wave 2 would, by design, have missing Wave 1 data); and b)

allowed Wave 1 measures of the outcome variables to be controlled for in the analysis. The initial dataset was further restricted based on students' grade level and race/ethnicity. Students who were in ninth grade at Wave 2 (n=846) were excluded from analyses because the variables of interest may be influenced by the transition from middle to high school. Therefore, the majority of the analysis sample consisted of students who were in either sixth or seventh grade at Wave 1, and either seventh or eighth grade at Wave 2. Further, students who reported their race/ethnicity as anything other than African American, American Indian, Hispanic/Latino, or White were excluded (n=331) because sample sizes for the other race/ethnic groups were lower than the recommended minimum for the study's analysis methods (Kline, 2005). Combined, these restrictions yielded an analytic sample of 2,063.

Table 1 provides demographic characteristics of the overall analytic sample and the four race/ethnic subgroups. The racial/ethnic composition of the analytic sample closely mirrored the diversity of the communities from which the sample was drawn: 33% American Indian, 30% White, 27% African American, and 10% Hispanic/Latino. The sample was almost even divided by gender, with 52.3% (n=1,079) identifying as female. At Wave 2, the average age of participants was 13.3 (SD=.85) and nearly all students were in seventh (n=1,048; 51%) or eighth grade (n=998; 48%). Approximately 1% of students (n=17) were in sixth grade at Wave 2. These students were also in sixth grade at Wave 1, suggesting they had been retained in grade 6. The sample was predominately low-income, with two-thirds (67.5%) of the sample receiving free or reduced price lunches. Approximately 28% of the students had been retained at least once during their educational career. Although individual level data regarding academic performance were not available, aggregate district-level data indicate that less than one-third of middle school

Table 1.

Demographic Characteristics for Full Analytic Sample (N=2,063) and Four Race/Ethnic Sub-Groups

	Full Sample *(N=2,063)*		African American *(n=562)*		American Indian/Native American *(n=671)*		Hispanic/Latino *(n=209)*		White *(n=621)*	
Characteristic (at Wave 2)	*N*	%	*N*	%	*n*	%	*n*	%	*n*	%
Gender										
Male	984	47.7	260	46.3	302	45.0	106	50.7	316	50.9
Female	1079	52.3	302	53.7	369	55.0	103	49.3	305	49.1
Grade level										
Sixth	17	0.8	8	1.4	2	0.3	3	1.4	4	0.6
Seventh	1,048	50.8	285	50.7	341	50.8	110	52.6	312	50.2
Eighth	998	48.4	269	47.9	328	48.9	96	45.9	305	49.1
Free/reduced lunch eligible	1,372	67.5	463	83.3	447	66.8	189	92.6	273	44.0
Previous retention(s)	579	28.1	197	35.1	173	25.8	77	36.8	132	21.3

Note. Percentages may not equal 100% due to rounding.

students in the RAP counties performed at or above grade level on reading and math standardized tests in 2012-13 (North Carolina Department of Public Instruction, 2014).

Measures

Items from three scales of the School Success Profile (SSP; Bowen & Richman, 2008) were used to measure the central constructs in the proposed study. A self-report survey designed for use with middle- and high-school students, the SSP includes items that address various aspects of students' social environments (e.g., their family, peers, school, neighborhood) as well as their health and well-being. Although psychometric properties have been established for most SSP scales (Bowen, Rose, & Bowen, 2005), two of the three scales used in this study were added during a 2008 revision of the SSP and psychometric properties have yet to be established in the published literature. The two scales contain items intended to measure constructs related to academic relevance and optimism. In addition, none of the SSP measures are known to have been tested with American Indian students in previous studies. A full list of the items in each of the three SSP scales can be found in Appendix A. Correlations, means, and standard deviations for the items can be found in Appendix B.

Academic relevance: Relevance strategy use. Teachers' use of relevance-related instructional strategies was measured using the SSP *Academic Relevance* scale from the Wave 1 data collection. The five-item scale asked youth to report on the extent to which their teachers encourage students to think about the future, and the extent to which teachers relate classroom lessons to the real world, student interests, student experiences, and potential future jobs and careers. Response categories ranged from 1 (*strongly disagree*) to 4 (*strongly agree*). The Cronbach's alpha reliability was .86 in this sample.

Future-oriented optimism. The 10-item SSP *Success Orientation* scale was used to measure future-oriented optimism at Wave 1 and Wave 2. These items asked students to report the extent to which they have positive feelings about the future, believe they have the necessary skills for future success, and have confidence in their ability to be successful in the future. Response categories ranged from 1 (*strongly disagree*) to 4 (*strongly agree*). In this sample, the Cronbach's alpha reliability was .92 at Wave 1 and .94 at Wave 2.

School engagement. Students' emotional engagement in school was the outcome variable in the current model and was measured using the seven-item SSP *School Satisfaction* scale at Wave 1 and Wave 2. These items asked students to report the extent to which they enjoy going to their school, get along well with teachers and other students, feel they are getting a good education, and feel a sense of belonging at school. Response categories ranged from 1 (*not like me*) to 3 (*a lot like me*). In this sample, Cronbach's alpha reliability was .84 at Wave 1 and .86 at Wave 2.

Other studies of emotional engagement contain substantial variation in how the construct has been conceptualized and measured. Items on the SSP School Satisfaction scale bring together three aspects that are commonly included in prior studies: (a) belonging (Finn & Voelkl, 1993; Goodenow, 1993); (b) student-teacher relationships (Appleton, Christenson, Kim, & Reschly, 2006; Finn & Voelkl, 1993; and (c) affective responses, such as happiness and enjoyment (Skinner & Belmont, 1993; Patrick, Skinner, & Connell, 1993). Overall, the SSP scale is most similar to one used by Johnson et al. (2001), which included items related to bonding/belonging, relationships, and happiness.

Control variables. Eligibility for free/reduced price meals (a generally accepted proxy for socioeconomic status), gender, and previous grade retention were included as control

variables in tests of the hypothesized conceptual model. These variables have been shown in previous studies to be predictive of engagement (Li & Lerner, 2011; Woolley & Bowen, 2007) and optimism (Andretta et al., 2013). Gender was coded as 1=female and 0=male. Free/reduced lunch status was coded as 1=yes and 0=no. Grade retention was measured through a single item that asked how many times students have been retained (i.e., held-back) and was coded as 1=prior retention(s) and 0=no prior retentions.

Analysis Procedures

The analysis plan included obtaining descriptive statistics, and conducting two phases of confirmatory factor analysis (CFA), and two phases of full structural equation modeling (SEM). Univariate statistics describing the sample (e.g., means, frequencies) were calculated using SPSS version 19.0. The CFAs answered questions related to the quality of data gathered with the SSP items and whether these items performed equivalently for students from different racial/ethnic groups (Study Aim 1). The CFAs established a measurement model for the three constructs of interest which was then used in the full SEM analysis phases. The SEM phases tested the hypothesized structural relationships among the variables of interest and whether these relationships varied for students from different racial/ethnic groups (Study Aim 2). The SEM approach allowed for testing both the direct and indirect effects of teachers' use of relevance strategies on student engagement through students' future-oriented optimism. The ability to test simultaneous equations instead of models with only one dependent variable (as in multiple regression) is a strength of SEM (Hoyle, 2012). The following sections describe elements of the analysis that apply to both Study Aim 1 and Study Aim 2.

CFA and SEM model estimation. CFA and SEM analyses were conducted using Mplus version 7 (Muthén & Muthén, 2012), based on the software's ability to adequately handle

specific characteristics of the dataset, including: the presence of ordinal variables, non-normal distributions, missing data (ranging from 2% to 5%), and nesting (i.e., individual students clustered within schools). Models were tested using the weighted least squares means and variances adjusted (WLSMV) estimator. WLSMV is preferable to default SEM procedures (i.e., maximum likelihood estimator and covariance input matrix of raw data) because WLSMV is a robust estimator capable of providing accurate estimates and standard errors when modeling ordinal, non-normally distributed data (Flora & Curran, 2004).

The WLSMV estimator handles ordinal data by creating a special correlation matrix that takes into account the measurement level of the variables. Specifically, WLSMV generates a polychoric correlation matrix of the observed indicators which is then used as the input matrix and analyzed with an appropriate weight matrix (Bowen & Guo, 2012). The polychoric correlation matrix is a mathematically theoretical matrix that assumes: (a) a continuous, normally distributed phenomenon underlies the ordinal categories used to measure the phenomenon and (b) there are thresholds on this distribution at which a respondent chooses one ordinal response category rather than another (Flora & Curran, 2004). Each ordinal variable will have multiple thresholds, specifically, one fewer threshold than the number of response options.

The presence of thresholds introduces additional modeling concerns. Specifically, modeling thresholds introduces more parameters to be estimated, which affects identification of the model (Millsap & Yun-Tein, 2004). Model identification refers to whether adequate information exists to calculate an estimate for each parameter in the model (Bowen & Guo, 2012). To test theory, models need to be over-identified, which requires: (a) assigning a scale to each latent variable (i.e., the metric of the latent variable is set by fixing the factor loading of one of its indicators equal to 1.0) and (b) having more known information (e.g., elements in the

variance-covariance matrix of the data) than unknown parameters to be estimated in the hypothesized model (e.g., factor loadings, structural coefficients). For invariance tests in measurement models based on polychoric correlations, identification also requires constraints on certain thresholds. In the current study, the procedures for constraining selected thresholds recommended by Millsap & Yun-Tein (2004) were followed to establish measurement model identification. Identification of the structural model was established separately from the measurement model (Bowen & Guo, 2012) using the t-rule and "null-B" rule as recommended by Bollen (1989, p. 94).

Missing data were handled using full information maximum likelihood (FIML) procedures in Mplus. The FIML procedure allows all available information to be used for parameter estimation without deleting cases, thus avoiding the biased parameter estimates likely to occur with other common approaches to handling missing values (Enders & Bandalos, 2001; Schafer & Graham, 2002). Possible issues related to shared variance and non-independence due to the multilevel nature of the data (i.e., students nested within schools nested within districts) were assessed through calculation of intraclass correlation coefficients (ICC; Singer & Willett, 2003). The percent of variance in the outcome variables between schools and between districts was quite small (ICCs less than 6% and less than 1%, respectively). Although these small ICCs indicated that modeling of data as nested was not required (Singer & Willett, 2003), Mplus' CLUSTER option was used to adjust for any non-independence of observations when computing standard errors and chi-square tests of model fit (Muthén & Muthén, 1998-2012).

Overall model fit criteria. Evaluation of overall model fit was based on the statistical significance and magnitude of factor loadings, the substantive justification for the model, and the following combination of fit indices (Bowen & Guo, 2012; Kline, 2005): the Satorra Bentler

Scaled χ^2 (SB χ^2; χ^2 adapted for WLSMV by Mplus), the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), and the Root Mean Square Error of Approximation (RMSEA). A non-significant SB χ^2 is desirable and indicative of overall good model fit. However, non-significant SB χ^2 values were unlikely in the current study given the known sensitivity of the χ^2 statistic to large sample sizes (Hoyle, 2012). Because of this sensitivity, it is generally recommended that the χ^2 be evaluated in conjunction with fit criteria that quantify the degree of model fit along a continuum (Hoyle, 2012). However, there is ongoing debate among methodologists regarding which fit indices are best and how strictly guidelines for cutoff values should be followed. Consistent with the most current guidelines, CFI and TLI values greater than .95 were considered indicative of adequate fit (Hu & Bentler, 1999; West, Taylor, & Wu, 2012). RMSEA values less than .06 were considered indicative of good/close model fit to the data (Hu & Bentler, 1999; West, Taylor, & Wu, 2012) and values between .06 and .08 were considered indicative of reasonable model fit (Browne & Cudeck, 1992). The 90% confidence interval (CI) of the RMSEA value was also considered to account for imprecision in the RMSEA point estimate; an upper bound CI value of .08 or less was considered indicative of good fit.

In cases of poorly fitting models, modification indices (provided by Mplus), explained variance, and residual correlations were examined for possible areas of model misspecification. Following the best practice guidelines, only one parameter at a time was changed and the re-specified model was tested and evaluated before further modifications were considered (Byrne, 2012). Further, model re-specifications were undertaken only when there was strong substantive and theoretical rationale for doing so (Byrne, 2012; Hu & Bentler, 1999).

Power analysis. MacCallum, Browne, & Sagawara (1996) proposed guidelines for conducting power analysis for CFA and SEM using alpha (α), sample size (N), degrees of

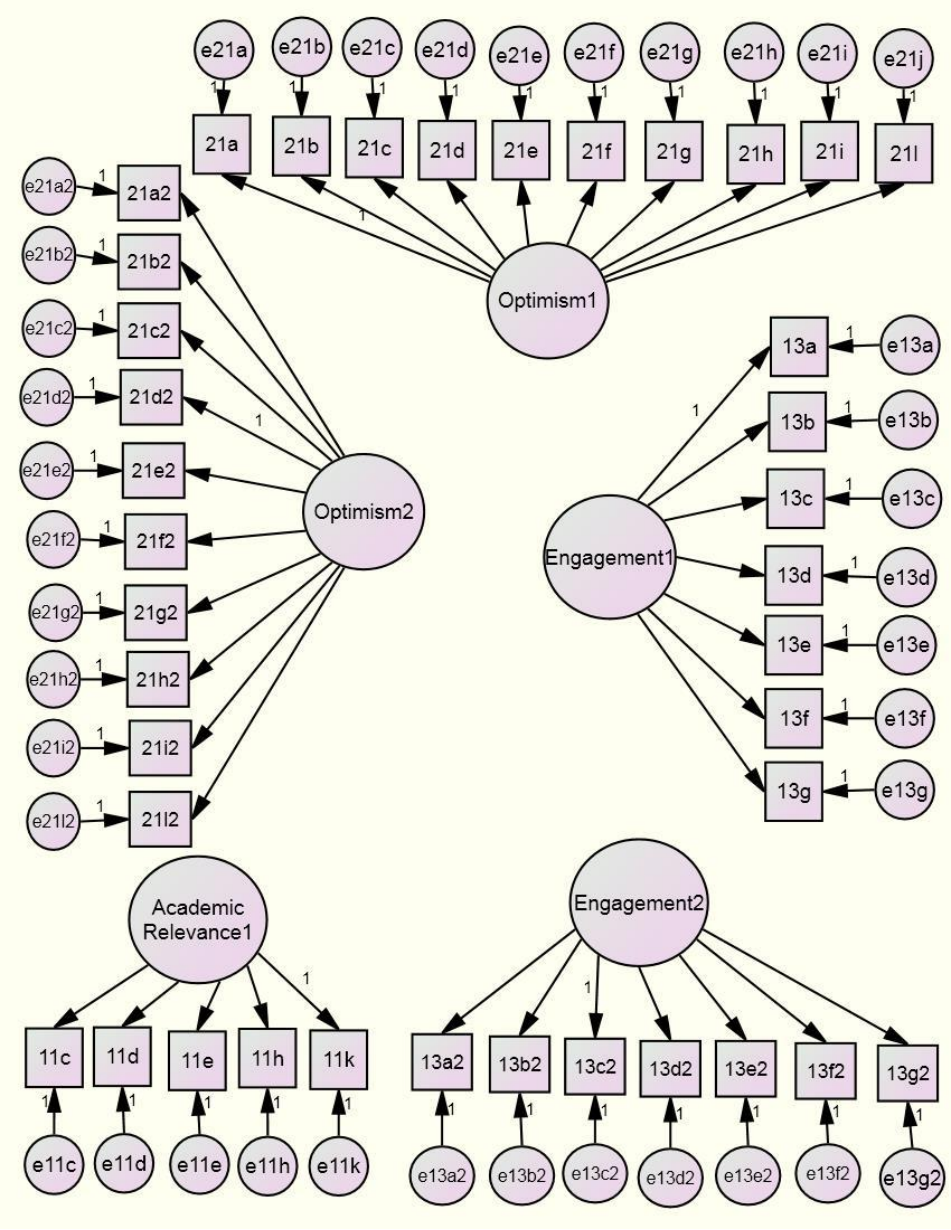
freedom of the tested model (*df*), and effect size, as measured by commonly accepted RMSEA values for close (.05) and not-close (.08) model fit. Although α and effect size are constants in these calculations, *df* and N varied across the numerous models tested in the proposed study, so power for each test of model fit varied accordingly. To ensure each test of model fit had sufficient power, a power analysis was conducted for the model having the fewest degrees of freedom (i.e., a fully unconstrained model with many estimated parameters) and the smallest racial/ethnic subgroup (i.e., Hispanic/Latino students). In this worst-case scenario, with α=.05, effect size=.03 (RMSEA difference between close and not-close fit), *df*=58, and N=209, power was estimated at approximately .83, which is consistent with the generally accepted minimum power value of .80 (MacCallum et al., 1996). Because power generally increases as the degrees of freedom or sample size increases, the results of this power analysis represented the lower bound of power that applied to model tests conducted in this study.

The following sections describe analysis steps specific to each study aim.

Study aim 1. CFAs were conducted separately with each of the four race/ethnic groups to determine whether the underlying factor structure of the data was consistent with the factor structure hypothesized by the instrument developers (Research Question 1A, Figure 2; Bowen & Richman, 2008; Bowen et al., 2005). Overall model fit, parameter estimates, and modification indices were examined and model re-specification was undertaken if warranted (as described above). The four resulting group-specific models served as the basis for subsequent measurement invariance testing (Byrne, 2012) to determine if the measures performed equivalently across race/ethnic subgroups (Research Question 1B). Measurement invariance tests are usually conducted with the hope that invariance across groups will be found because it allows for

Figure 2.

Hypothesized Measurement Model for Academic Relevance, Optimism (Time 1 and 2), and School Engagement (Time 1 and 2) Latent Constructs



Note: Correlations between all latent factors are modeled but not shown.

conducting tests of substantive hypotheses and group differences with greater confidence in the validity of the measures.

Multiple group analysis: Model specification and invariance testing procedures. Tests of measurement invariance across racial/ethnic groups (Research Question 1B) were conducted in a multiple-group confirmatory factor analysis (MCFA) framework following procedures recommended by Byrne (2012) and Hoyle (2012). The first step in the MCFA framework is the estimation of a configural model, which simply tests whether the number of factors and the factor loading patterns are the same across groups. In this test, factor means are constrained to zero and residuals are fixed at one; in addition, one factor loading is fixed at one for identification purposes. The configural model estimates the four group-specific models simultaneously rather than separately, thus providing parameter estimates for each group at the same time. Because no equality constraints on loadings or thresholds are imposed across groups in a configural model (other than those imposed for identification purposes), the fit of this model serves as the baseline against which subsequent tests of invariance are made.

Following estimation of the configural model, invariance testing then continued with a sequence of progressively restrictive models. In each successive test, specific sets of parameters were constrained to be equal across groups and fit statistics were evaluated to determine if the specific parameters under scrutiny were indeed invariant across groups. According to the literature on invariance testing with WLSMV and ordinal variables, the parameters of interest for invariance testing are the factor loadings (i.e., lambdas) and the thresholds. Based on the most recent recommendations (Byrne, 2012; Hoyle, 2012; Okech, 2012; Sass, 2011), the sequence of invariance testing proceeded as follows. First metric, or weak, invariance was modeled in which all factor loadings (and certain thresholds, for identification purposes) were constrained equal

across groups. If the evaluation of model fit criteria indicated invariance of factor loadings, testing progressed to a model of scalar, or strong, invariance in which all factor loadings and item thresholds were constrained equal across groups. Mplus' Theta parameterization was used throughout the invariance testing sequence (Millsap & Yun-Tein, 2004; Muthén and Asparouhov, 2002).

Multiple group analysis: Invariance model fit criteria. Because the configural model described above does not impose any equality constraints across groups beyond those required for model identification, it is the least restrictive model being tested (i.e., it has the fewest degrees of freedom and most parameters estimated). As such, it is better able to reproduce the input covariance matrix (i.e., the covariance matrix of the observed data), resulting in better fit than more restrictive models in which constraints are imposed and fewer parameters are estimated. Although model fit gets worse when constraints are imposed, the question is whether it gets *significantly* worse. If model fit does not get significantly worse with the addition of constraints, the more restrictive model is retained because it is more parsimonious (i.e., it has fewer parameters estimated and more degrees of freedom).

The change in the chi-square statistic per degrees of freedom (calculated by the Mplus DIFFTEST procedure; Muthén & Muthén, 1998-2012) was used to determine if the particular equality constraints imposed in a model resulted in significantly worse fit than the less constrained model (Byrne, 2012). A non-significant change in chi-square indicated model fit was not significantly worsened by constraining the parameters to be equal across groups. That is, the specific set of parameters being tested could be considered invariant across groups.

Conversely, a significant change in chi-square indicated a significant worsening of model fit, meaning the set of parameters being tested could not be considered equivalent across groups.

Rather, the values of the specific parameters being tested were moderated by group membership (e.g., race/ethnicity; Bowen & Guo, 2012). In these cases, a sequence of item-level tests informed by the modification indices was conducted to identify the specific parameters contributing to the inequality between groups. Equality constraints on non-invariant parameters were relaxed, allowing for continued testing of remaining parameter sets under a partial measurement invariance (PMI) framework (Byrne, 2012).

Some authors (e.g., Byrne, 2012; Byrne, Shavelson, & Muthén, 1989) posit that in situations when the number of noninvariant items is small compared to the total number of items, PMI is an appropriate approach to handling noninvariance within one set of parameters (e.g., factor loadings) while allowing tests of invariance of other parameters (e.g., thresholds) to continue. However, researchers are also encouraged to examine both the statistical and the practical impact of noninvariance. The impact of noninvariance can be considered trivial when both the full measurement invariance model and the partial measurement invariance model (PMI) lead to the same statistical and practical conclusions regarding mean level differences between groups on the construct (Sass, 2011). In such cases, use of the more parsimonious full invariance model, rather than the PMI model, is acceptable (Sass, 2011). As recommended in the current literature (Chen, 2008; Sass 2011), when the sequence of testing indicated noninvariance, a supplementary analysis was conducted to assess the impact of noninvariant items and to determine which model (i.e., full invariance or PMI) should be used in further analyses. The detailed methods and results of these supplementary analysis are presented in Appendix C. The final measurement model resulting from the invariance testing and supplemental testing was then used to appropriately specify the measurement portion of the full SEM models tested in Study Aim 2.

Study aim 2. Full SEM analyses were used to: (a) test for latent mean level differences in teachers' use of relevance strategies, students' future-oriented optimism, and students' school engagement across racial/ethnic groups (Research Question 2A); (b) test the hypothesized direct and indirect relationships depicted in the conceptual model (Research Questions 2B-2D); and (c) determine whether the presence and significance of these relationships differed for students of different racial/ethnic groups (Research Question 2E). Unlike the tests of measurement invariance, group level means and the hypothesized relationships are of substantive interest; there is no requirement or expectation that they will be equivalent across groups.

Test of latent mean differences across race/ethnicity. Group differences in latent factor means were tested by setting the latent factor mean for one group equal to zero and freely estimating the means of the other three groups. In Mplus, latent means are not directly estimated; rather, the latent mean for each group is estimated in reference to another group. For this reason, the difference in group means (M_{Diff}) and the associated statistical significance are reported rather than actual estimates of each group's mean.

Whole-group SEM analysis. The hypothesized conceptual model predicts that teachers' use of relevance strategies will have a direct effect on students' school engagement, as well as, an indirect effect on engagement through a relationship with future optimism. Although testing a mediation model would ideally involve three or more waves of data (MacKinnon, 2008; Maxwell & Cole, 2007), only two waves of RAP data were available at the time of this study. According to Cole & Maxwell (2003) and Taris & Kompier (2006), a two-wave mediation test can be conducted by testing the hypothesized mediational path in two steps (a) testing the relationship between the predictor at Time 1 and the mediator at Time 2 (Path A), controlling for the mediator at Time 1, and (b) testing the relationship between the mediator at Time 1 and the

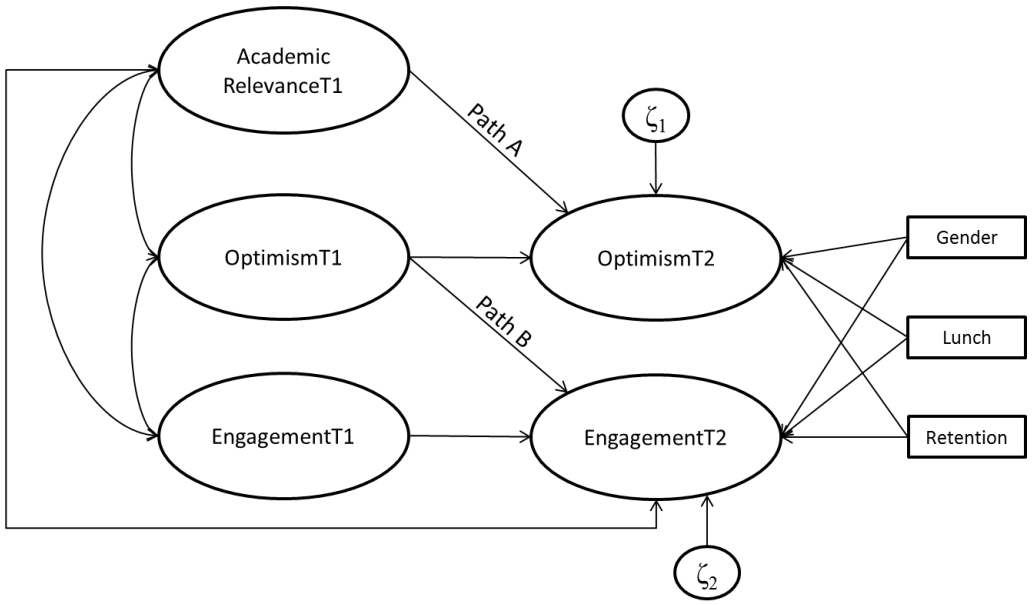
outcome at Time 2 (Path B), controlling for the outcome at Time 1. Under an assumption of stationarity (i.e., the relationships among variables do not change over time), the path between the mediator at Time 1 and the outcome at Time 2 would be equivalent to the untested, hypothetical path between the mediator at Time 2 and the outcome variable at Time 3 (Cole & Maxwell, 2003). Under this assumption, the product of Path A and Path B provides an estimate of the mediational relationship. Although the stationarity assumption cannot be empirically tested without at least three waves of data, Cole & Maxwell (2003) posit that a half-longitudinal approach is superior to cross-sectional approaches, which fail to control for prior levels of the dependent variables.

Based on these recommendations, the following relationships were estimated to test the hypothesized mediational model: (a) the path between *Academic Relevance* at Time 1 and *Optimism* at Time 2 (PATH A), controlling for Time 1 *Optimism*; (b) the path between *Optimism* at Time 1 and *Engagement* at Time 2 (PATH B), controlling for Time 1 *Engagement*; and (c) the direct association between *Academic Relevance* at Time1 and *Engagement* at Time 2. In addition, gender, receipt of free/reduced lunch, and previous grade retentions were included as covariates to control for their potential effects on the mediator and outcome variables. The analytic model is presented in Figure 3; for the sake of simplicity, the measurement portion of the model is not shown. The model was estimated first with the full sample as one group and model fit was evaluated as described in the model fit criteria section earlier.

Multiple group SEM analysis: invariance testing procedures. The final full model obtained during the whole-group SEM served as the baseline for the second phase, in which amultiple-group SEM analysis was conducted to test whether the relationships in the model were

Figure 3.

Analytic Model Testing Hypothesized Direct and Indirect Relationships Among Academic Relevance, Optimism, and School Engagement in a Half-Longitudinal Design



Note: Measurement model of latent variables not shown.

the same for students from different racial/ethnic groups (Research Question 2E). These tests sought to determine whether relationships between variables were moderated by group membership (i.e., race/ethnicity; Bowen & Guo, 2012). Similar to the tests of measurement invariance, these tests were conducted by estimating and comparing the fit of a hierarchy of progressively restrictive models. As recommended by Bollen (1989, p. 357-359), the sequence of testing proceeded as follows:

a) The same pattern of fixed and free structural paths and relationships between latent exogenous factors (ϕs) and between latent exogenous and endogenous factors (γs) was specified across groups.
b) In addition to (a), all structural paths from exogenous to endogenous factors (γs; i.e., the Γ matrix) were constrained equal across groups. This model was compared to (a).
c) In addition to (b), the variance-covariance matrix of structural errors (Ψ) was constrained equal across groups. This model was compared to (b).
d) In addition to (c), the variance-covariance matrix of the exogenous factors (Φ) was constrained equal across groups. This model was compared to (c).

Multiple group SEM: evaluating change in model fit during invariance testing. As with the CFA invariance testing above, change in the chi-square statistic as determined by DIFFTEST was used to evaluate the invariance of the structural parameters under scrutiny at each step of the sequence. If deterioration of fit was statistically significant when a structural path was constrained (i.e., the path was non-invariant), the path was allowed to vary across groups.

Reliability. Because SEM methods partition error from scale scores, reliability is not directly relevant to factor scores used in general SEM analyses. However, because internal consistency reliability is so commonly reported in the literature, Cronbach's alpha (α) was

calculated using SPSS version 19.0 for each scale resulting from the final CFA model. Standard cutoff values were used, with $\alpha \geq .70$ indicating adequate reliability, $\alpha \geq .80$ indicating very good reliability, and $\alpha \geq .90$ indicating excellent reliability (Kline, 2005).

CHAPTER IV
RESULTS

This chapter presents results of each analysis, organized by study aim. Analyses related to Study Aim 1 answered questions about the quality of data gathered with SSP items and whether items performed equivalently with students from different racial/ethnic groups. For Study Aim 1, results related to the baseline measurement models are presented first, followed by invariance testing results. Given the complexity of the invariance testing sequences, results from these analyses are presented separately for each of the five latent variables. Analyses related to Study Aim 2 tested the hypothesized structural relationships among the variables of interest and whether these relationships varied for students from different racial/ethnic groups. For this Aim, results related to the initial structural model are presented first, followed by results of the invariance testing of the structural model.

Study Aim 1: Establishing the Measurement Model and Testing for Invariance Across Racial/Ethnic Groups

Establishing baseline models. The hypothesized factor structure (Figure 2; Bowen & Richman, 2008; Bowen et al., 2005) was tested separately with each of the four race/ethnic groups to establish baseline models prior to invariance testing (Research Question 1A). Overall, the baseline measurement model had good fit for each of the four race/ethnic groups (Table 2). All individual items loaded strongly and significantly on the hypothesized factors, with standardized loadings ranging from .54 to .93 for African Americans, from .43 to .96 for Hispanic/Latinos, from .47 to .96 for Whites, and from .59 to .92 for Native Americans.

Table 2.

Confirmatory Factor Analysis Fit Statistics for Racial/Ethnic Group-Specific Baseline Measurement Models

	Model Fit					
Racial/Ethnic Group	SB χ^2	*df*	*p*-value	CFI	TLI	RMSEA (90% CI)
African American	939.96	692	.000	.984	.983	.025 (.021-.029)
Hispanic/Latino	786.98	692	.007	.984	.983	.026 (.014-.034)
White	923.16	692	.000	.989	.988	.023 (.019-.027)
Native American	858.42	692	.000	.992	.992	.021 (.019-.022)

Although the SB chi-square statistic was significant for each race/ethnic group model, this finding was expected given the large sample size of the study. Preestablished criteria for each of the fit indices (i.e., CFI, TLI, and RMSEA) were met. Across groups, CFI values ranged from .984 to .992; TLI values ranged from .983 to .992; RMSEA values ranged from .019 to .026 and all RMSEA upper CIs were below the pre-specified cutoff. Given the evidence of good model fit across the four racial/ethnic groups, these models were retained as the baseline for subsequent measurement invariance testing.

Testing measurement invariance. With the establishment of well-fitting baseline models for each group, analysis turned to tests of measurement invariance to determine whether the items performed equivalently across groups (Research Question 1B). Given the complexity of testing invariance for five latent factors across four racial/ethnic groups (Byrne & van de Vijver, 2010), the sequence of invariance testing was conducted separately for each latent variable. The conclusions drawn from these tests are the same as what would be obtained testing the whole model at the same time.

As described in the methods, the following sequence of models was tested: (a) configural (with all factor loadings and thresholds free to vary across groups, other than constraints imposed for model identification purposes), (b) metric (with all factor loadings constrained across groups and certain thresholds constrained for model identification), and (c) scalar (with all factor loadings and thresholds constrained across groups). Model fit statistics and a summary of the invariance testing results are presented in Table 3 for each model in this sequence of testing. Overall, configural, metric, and scalar invariance were found for two of the five latent factors (i.e., Academic Relevance and Optimism Time 1). Partial measurement invariance was supported for the remaining three latent factors (i.e., Optimism Time 2, Engagement Time 1, and

Table 3.

Multiple Group Confirmatory Factor Analysis Model Fit Statistics and Invariance Testing Results by Latent Factor

	Model Fit						Invariance Testing		
Factor and Model	SB χ^2	*df*	*p*-value	CFI	TLI	RMSEA (90% CI)	Comparison Model	$\Delta\chi^2$	Δdf
Academic Relevance									
1.Configural	47.34	20	.001	.998	.997	.052 (.033-.072)			
2.Metric Invariance	56.82	32	.004	.999	.998	.039 (.022-.056)	Model 1	13.66 ^{NS}	12
3.Scalar Invariance	90.27	59	.006	.998	.999	.033 (.018-.045)	Model 2	39.94 ^{NS}	27
Optimism (T1)									
1.Configural	391.07	140	.000	.994	.992	.060 (.053-.067)			
2.Metric Invariance	394.02	167	.000	.994	.994	.052 (.046-.059)	Model 1	33.01 ^{NS}	27
3.Scalar Invariance	411.23	224	.000	.995	.996	.041 (.035-.047)	Model 2	69.51 ^{NS}	57
Optimism (T2)									
1.Configural	597.95	140	.000	.993	.991	.081 (.074-.088)			
2.Metric Invariance	577.49	167	.000	.994	.993	.070 (.064-.076)	Model 1	30.16 ^{NS}	27
3.Scalar Invariance	580.15	224	.000	.995	.996	.056 (.051-.062)	Model 2	92.61**	57
4.Partial Scalar Invariance	545.73	215	.000	.995	.996	.056 (.050-.061)	Model 2	48.72 ^{NS}	48

Engagement (T1)									
1.Configural	154.39	52	.000	.995	.992	.062 (.051-.074)			
2.Metric Invariance	157.05	70	.000	.996	.995	.049 (.039-.060)	Model 1	25.08 ^{NS}	18
3.Scalar Invariance	185.38	88	.000	.995	.995	.047 (.037-.056)	Model 2	38.75 **	18
4.Partial Scalar Invariance	174.12	86	.000	.996	.996	.045 (.035-.054)	Model 2	21.40 ^{NS}	16
Engagement (T2)									
1.Configural	212.74	52	.000	.989	.983	.078 (.067-.089)			
2.Metric Invariance	219.27	70	.000	.990	.988	.065 (.055-.074)	Model 1	40.15**	18
3.Partial Metric Invariance	207.86	69	.000	.991	.989	.063 (.053-.073)	Model 1	27.18 ^{NS}	17
4.Scalar Invariance	229.30	87	.000	.991	.991	.057 (.048-.066)	Model 3	40.47**	18
5.Partial Scalar Invariance	213.29	84	.000	.991	.991	.055 (.046-.064)	Model 3	20.94 ^{NS}	15

Note: NS = not significant

Engagement Time 2). The following sections present results for each of the five latent variables. Reporting of results is limited to the parameters involved in the invariance testing: factor loadings (i.e., lambdas) and thresholds.

Academic relevance. The configural model had good fit, and both metric and scalar invariance were established. Together, these results indicate that the factor loadings and thresholds of items used to measure academic relevance are fully invariant across the four racial/ethnic groups.

Optimism. For Optimism at Time 1, the configural model had good fit, and both metric and scalar invariance were established. Together, these results indicate that the factor loadings and thresholds of items used to measure optimism at Time 1 are fully invariant across the four racial/ethnic groups.

For Optimism at Time 2, the configural model displayed good model fit based on the CFI and TLI fit indices. However, both the RMSEA point estimate (.081) and the upper bound of the CI (.088) were just above the desired cut-off value of .08, suggesting less than "reasonable" fit (Browne & Cudeck, 1992). A careful examination of modification indices did not reveal any theoretically justifiable modifications to the model. As such, this configural model was retained for subsequent invariance testing with the acknowledgement that model fit was less than ideal.

Metric invariance was established, indicating that factor loadings could be considered invariant across groups. However, based on the Mplus DIFF test, the decrement in fit from the metric invariance model to the scalar invariance model was significant, indicating some noninvariance among the thresholds. An additional sequence of tests was conducted in which thresholds were constrained one at a time to identify the specific item parameters contributing to the inequality between groups. The process revealed that six of the 30 thresholds (20%) were not

fully invariant across the four race/ethnic groups (Table 4); these non-invariant thresholds were allow to be freely estimated in the subsequent test of partial scalar invariance. Based on the Mplus DIFF test, partial scalar invariance was supported. Together, these results indicate that for the items used to measure optimism at Time 2: (a) factor loadings are fully invariant across the four racial/ethnic groups, and (b) thresholds demonstrate partial invariance. However, post-hoc analysis (Sass, 2011; see Appendix C) indicated that the non-invariance among thresholds did not affect conclusions about latent mean differences between the four groups. For this reason, the more parsimonious full measurement invariance model in which all factors and all thresholds are modeled as invariant was retained for the final measurement model (Sass, 2011).

Engagement. For Engagement at Time 1, the configural model had good fit. Metric invariance was established, indicating that factor loadings could be considered invariant across the race/ethnicity groups. Testing for scalar invariance revealed that one of the 14 thresholds (7%) was not fully invariant across the four groups (Table 4); this threshold was then allowed to be freely estimated in a partial scalar invariance model. Partial scalar invariance was supported. Together, these results indicate that for the items used to measure engagement at Time 1: (a) factor loadings are fully invariant across the four race/ethnic groups, and (b) thresholds demonstrate partial invariance. However, post-hoc analysis (Sass, 2011; see Appendix C) indicated that the non-invariance among thresholds did not affect conclusions about latent mean differences between the four groups. For this reason, all factors and all thresholds are modeled as invariant was retained for the final measurement model (Sass, 2011).

For Engagement at Time 2, the configural model displayed good fit based on the CFI and TLI. Although the RMSEA point estimate (.078) was below the desired cut-off value of .08, the upper bound of the CI (.089) was just above the cut-off, suggesting less than “reasonable” fit

Table 4.

Values of Partially Noninvariant Thresholds for each Racial/Ethnic Group

		Threshold Values			
Factor	Threshold	African American	Hispanic/ Latino	White	Native American
Optimism (T2)	21C$3	-0.328	-0.050	-0.442	-0.442
	21D$3	-0.416	-0.416	-0.612	-0.612
	21E$3	0.144	-0.178	-0.347	-0.178
	21F$3	-0.473	-0.668	-0.668	-0.473
	21H$3	-0.797	-0.797	-1.051	-0.797
	21I$3	-0.830	-0.648	-1.051	-0.830
Engagement (T1)	13D$2	0.122	0.122	-0.092	0.356
Engagement (T2)	13D$2	0.291	0.291	-0.032	0.291
	13F$2	0.656	0.656	0.238	0.238
	13G$2	0.448	0.448	0.102	0.102

(Browne & Cudeck, 1992). However, modification indices did not reveal any theoretically justifiable modifications to the model. As such, this configural model was retained for subsequent invariance testing with the acknowledgement that model fit was less than ideal.

The metric invariance test revealed one localized area of noninvariance: the loading for item 13A *("I enjoy going to this school"*) was invariant for only three of the four groups. The unstandardized factor loading for this item was substantially lower for Hispanic/Latino students (λ=.371) than the loading for the other three race/ethnic groups (λ=.625). A partial metric invariance model in which this parameter was allowed to be freely estimated for Hispanic/Latino students, but constrained equal across the other three race/ethnic groups, was tested. Partial metric invariance was supported, allowing invariance testing to continue (Byrne, 2012).

Testing for scalar invariance revealed that three of the 14 thresholds (22%) were not fully invariant across the four groups (Table 4). A partial scalar invariance model, in which the non-invariant thresholds were freely estimated across groups, was supported. Together, these results indicate that for the items used to measure engagement at Time 2: (a) factor loadings demonstrate partial invariance; all are invariant except 13A for Hispanic/Latino students, and (b) thresholds demonstrate partial invariance. Post-hoc analysis (Sass, 2011; see Appendix C) indicated that the non-invariance among thresholds did not affect conclusions about latent mean differences between the four groups. For this reason, all thresholds are modeled as invariant in the final measurement model (Sass, 2011).

Final measurement model. The final measurement model was specified based on results of the invariance testing and the supplemental analysis of the practical and statistical impact of noninvariance. In the final measurement model, nearly all factor loadings were modeled as invariant across groups. The one exception was item 13A in the engagement scale (*"I enjoy*

going to this school"). The factor loading for this item was constrained equal across the African American, Native American, and White groups, but freely estimated for the Hispanic/Latino group. All thresholds were modeled as invariant in the final measurement model, based on the post-hoc analysis finding that the partial noninvariance did not affect conclusions about latent mean differences (Sass, 2011; Appendix C).

When the final measurement model was fitted to the data, a converged and admissible solution was obtained. Table 5 reports the unstandardized and standardized factor loadings for the final measurement model. It is important to remember that although the standardized values vary across groups, the unstandardized values were constrained equal (except item 13A for Hispanic/Latino students) and are therefore identical for the four groups. All individual items loaded strongly and significantly on the hypothesized factors, with standardized factor loadings ranging from .49 to .97. Although the SB chi-square statistic was significant, $\chi^2(3046) = 3703.62$, p=.000, this finding was expected given the large sample size of the study. Overall, the final measurement model demonstrated excellent fit based on the CFI (.989), TLI (.990) and RMSEA (.020; CI: .018-.023).

Study Aim 2 – Testing the Hypothesized Conceptual Model and Testing for Invariance Across Groups

Full SEM analyses were used to: (a) test for latent mean level differences in student perceptions of teachers' use of relevance strategies, students' future-oriented optimism, and students' school engagement across racial/ethnic groups (Research Question 2A); (b) test the hypothesized direct and indirect relationships between these constructs (Research Questions 2B-2D); and (c) determine whether the presence and significance of these relationships differed for students of different racial/ethnic groups (Research Question 2E).

Table 5.

Unstandardized and Standardized Factor Loadings for Latent Constructs for Four Racial/Ethnic Groups

		Standardized Loadings			
Factor	Unstandardized Loading[a]	African American	Hispanic/ Latino	White	Native American
Academic Relevance					
11c[b]	1.00	0.83	0.88	0.83	0.78
11d	1.10	0.86	0.87	0.86	0.87
11e	1.01	0.84	0.78	0.81	0.78
11h	0.88	0.80	0.77	0.78	0.79
11k	0.84	0.78	0.76	0.75	0.78
Optimism (T1)					
21a[b]	1.00	0.87	0.85	0.83	0.83
21b	1.03	0.88	0.82	0.84	0.87
21c	0.42	0.60	0.67	0.50	0.58
21d	0.89	0.85	0.86	0.79	0.77
21e	0.83	0.83	0.80	0.83	0.77
21f	0.90	0.85	0.84	0.87	0.84
21g	0.97	0.87	0.84	0.83	0.86
21h	1.00	0.87	0.90	0.89	0.88
21i	1.07	0.89	0.77	0.90	0.88
21l	1.19	0.91	0.84	0.92	0.88
Optimism (T2)					
21a2[b]	1.00	0.93	0.87	0.90	0.88
21b2	1.05	0.93	0.87	0.91	0.89
21c2	0.33	0.63	0.60	0.61	0.67
21d2	0.72	0.87	0.87	0.83	0.86
21e2	0.62	0.84	0.86	0.87	0.85
21f2	0.80	0.89	0.93	0.90	0.92

21g2	0.73	0.87	0.88	0.87	0.92
21h2	0.81	0.89	0.97	0.91	0.92
21i2	0.90	0.91	0.85	0.93	0.90
21l2	0.92	0.92	0.88	0.90	0.89
Engagement (T1)					
13a[b]	1.00	0.66	0.78	0.76	0.79
13b	0.97	0.65	0.59	0.71	0.67
13c	0.77	0.56	0.49	0.65	0.65
13d	1.09	0.69	0.67	0.73	0.70
13e	1.63	0.82	0.81	0.80	0.77
13f	1.55	0.81	0.94	0.90	0.90
13g	1.98	0.87	0.95	0.96	0.92
Engagement (T2)					
13g2[b]	1.00	0.84	0.89	0.92	0.89
13a2	0.72/0.56	0.75	0.72	0.77	0.77
13b2	0.53	0.64	0.70	0.67	0.76
13c2	0.61	0.69	0.71	0.68	0.72
13d2	0.59	0.68	0.73	0.76	0.67
13e2	0.84	0.80	0.83	0.78	0.79
13f2	1.04	0.85	0.85	0.91	0.92

Note: $\chi^2(df) = 3703.62$ (3046), p=.000; CFI = .989; TLI =.990; RMSEA = .020 (CI: .018-.023).
[a] Unstandardized factor loadings constrained to be equal across groups, expect 13a2, which is constrained equal for all groups except Hispanic/Latinos. All loadings significant at $p < .001$.
[b] Unstandardized factor loading fixed at one for model identification.

Table 6.

Comparison of Latent Factor Means across Four Racial/Ethnic Groups

	Academic Relevance	Optimism (T1)	Optimism (T2)	Engagement (T1)	Engagement (T2)
Comparison	Higher Mean; Mean Diff	Higher Mean; Mean Diff	Higher Mean; Mean Diff	Higher Mean; Mean Diff	Higher Mean; Mean Diff
AA & W	AA Diff = .32 (*p*=.002)	AA Diff = .55 (*p*=.000)	AA Diff = .82 (*p*=.000)	W Diff = .33 (*p*=.002)	W Diff = .23 (*p*=.190)
AA & HL	AA Diff = .29 (*p*=.036)	AA Diff = .75 (*p*=.000)	AA Diff = .85 (*p*=.000)	HL Diff = .28 (*p*=.003)	HL Diff = .31 (*p*=.022)
AA & NA	AA Diff = .19 (*p*=.110)	AA Diff = .27 (*p*=.033)	AA Diff = .54 (*p*=.001)	NA Diff = .24 (*p*=.093)	NA Diff = .17 (*p*=.290)
HL & W	HL Diff = .09 (*p*=.312)	W Diff = .20 (*p*=.141)	W Diff = .03 (*p*=.836)	W Diff = .05 (*p*=.652)	HL Diff = .07 (*p*=.724)
HL & NA	NA Diff = .04 (*p*=.759)	NA Diff = .48 (*p*=.001)	NA Diff = .32 (*p*=.088)	HL Diff = .04 (*p*=.800)	HL Diff = .13 (*p*=.486)
W & NA	NA Diff = .13 (*p*=.229)	NA Diff = .28 (*p*=.000)	NA Diff = .28 (*p*=.026)	W Diff = .08 (*p*=.584)	W Diff = .04 (*p*=.840)

Note: AA = African American; HL = Hispanic/Latino; W = White/Caucasian; NA = Native American

Latent mean differences between groups. Results of latent mean difference tests are presented in Table 6. African American students had significantly higher latent means on the Academic Relevance than White (M_{diff}=.32, p=.002) and Hispanic/Latino students (M_{diff}=.29, p=.036). There were no other significant differences between race/ethnic groups on Academic Relevance. At both time points, African American students had significantly higher Optimism latent means than all other groups (M_{diff}=.27, .55, and .75, for Native American, White, and Hispanic/Latino students respectively). Native American students had significantly higher Optimism means than White (M_{diff}=.28, p=000) and Hispanic/Latino students (M_{diff}=.48, p=.001) at Time 1, and higher means than White students (M_{diff}=.28, p=.026) at Time 2. At Time 2, the difference between Native American and Hispanic/Latino students on Optimism was no longer significant (M_{diff}=.32, p=.088). At Time 1, White and Hispanic/Latino students had significantly higher Engagement means than African American students (M_{diff}=.33, p=.002, and M_{diff}=.28, p=.003, respectively). At Time 2, there was only one significant difference in Engagement means: the mean of Hispanic/Latino students was significantly higher than that of African American students (M_{diff}=.31, p=.022).

Whole group SEM analysis. With the exception of a significant SB chi-square statistic, $\chi^2(804) = 1466.25$, p=.000, the initial full SEM model had adequate model fit (CFI = .987, TLI = .986, RMSEA = .020, CI = .018-.022). The model as a whole explained 34% of the variance in Engagement at Time 2. However, the hypothesized direct path between Academic Relevance atTime1 and Engagement at Time 2 was not significant (γ=.045, p=.484). Likewise, only one portion of the hypothesized mediational pathway was significant: Although Academic Relevance at Time 1 significantly and positively predicted the mediator (Optimism at Time 2; γ=.163, p=.000), Optimism at Time 1 did not significantly predict the dependent variable, Engagement at

Time 2 (γ = -.054, *p*=.282). These findings indicate that although teachers' use of academic relevance strategies significantly and positively predicted students' subsequent optimism, neither the hypothesized predictor (academic relevance strategies) nor the hypothesized mediator (optimism) significantly predicted students' subsequent engagement.

In addition to the main variables of interest, several covariates were included in the model to control for their effect on students' future-oriented optimism and school engagement. Optimism Time 2 and Engagement Time 2 were each significantly predicted by their respective Time 1 measures (γ =.339, *p*=.000, and γ =.579, *p*=.000, respectively). Students' gender significantly predicted future-oriented optimism (γ =.361, *p*=.000), suggesting that being female was associated with higher levels of optimism. Gender did not significantly predict engagement, and students' receipt of free or reduced meals did not significantly predict either optimism or engagement. Having a history of one or more grade retentions was significantly predictive of lower levels of optimism (γ = -.805, *p*=.000) and engagement (γ = -.430, *p*=.000).

Multiple group SEM analysis. To test for equivalence of structural paths across the four race/ethnic groups, the same model tested above was used to specify a multigroup model in which all structural path coefficients were freely estimated across groups. Model fit was very similar to that of the whole-group SEM model: $\chi^2(3494) = 4211.22$, *p*=.000, CFI = .987, TLI = .987, RMSEA = .020 (CI = .018-.022). This model, with structural paths allowed to vary for each group, was compared to a model in which structural regression pathways (i.e., the paths between latent variable predictors and outcomes, and the paths between observed covariates and latent variable outcomes) were constrained to be equal. Results of an Mplus DIFFTEST indicated that constraining these paths to be equal across groups did not significantly worsen model fit ($\Delta SB\chi^2$ (18) = 26.82, p =.08). The hypothesis that the relationships among Academic Relevance,

Optimism, and Engagement would differ significantly for students of different race/ethnic groups was not supported.

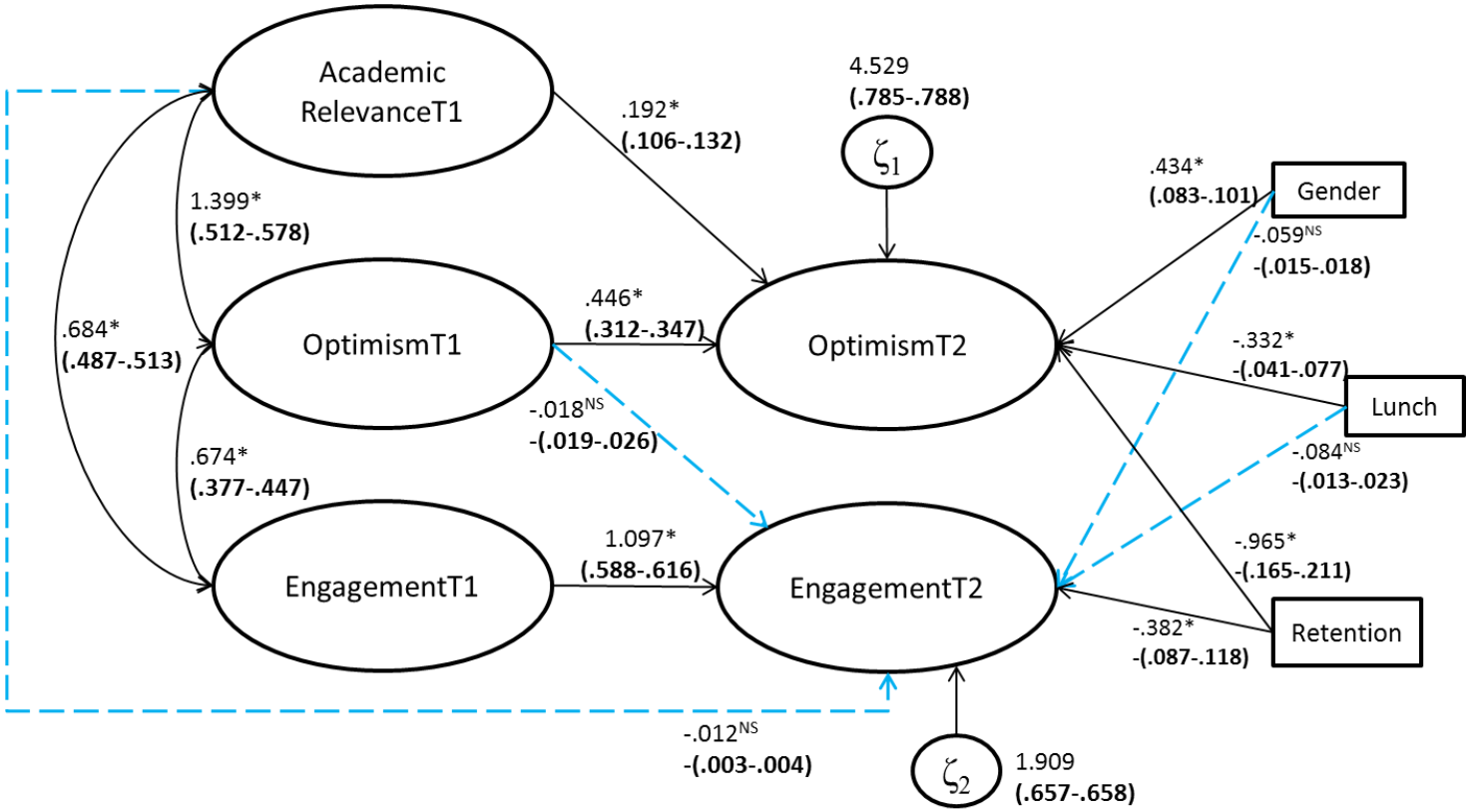
The model with constrained structural regression paths was then compared to a more restrictive model in which the variance-covariance matrix of structural errors (Ψ) were constrained to be equal across groups. Results showed that constraining these paths to be equal across groups did not significantly worsen model fit ($\Delta SB\chi^2$ (9) = 9.95, p =.35). This finding indicates that the amount of variance of the dependent variables explained by the model is not significantly different across groups.

The model with constrained structural regression paths and a constrained variance-covariance matrix of structural errors was then compared to a more restrictive model in which the variance-covariance matrix of the exogenous factors (Φ) was also constrained equal across groups. Results indicated that constraining these paths to be equal across groups did not significantly worsen model fit ($\Delta SB\chi^2$ (18) = 14.162, p = .72), which suggests: (a) the variances of the exogenous predictor variables were not significantly different across groups and (b) the relationships, or covariances, between these variables were not significantly different across groups.

Final SEM model. Based on the multiple group invariance test results, a final model was estimated in which all thresholds, all factor loadings (except item 13A for Hispanic/Latino students), all structural regression paths, the variance-covariance matrix of structural errors, and the variance-covariance matrix of exogenous factors were constrained. As with previous models, the SB chi-square statistic was significant, $\chi^2(3554) = 4132.66$, p=.000. Other fit indices suggest good model fit (CFI = .989, TLI = .990, RMSEA = .018, CI = .015-.020). Figure 4 presents the unstandardized path coefficients for the model and the range of standardized coefficients across

Figure 4.

Unstandardized and Standardized Parameter Estimates for Final Multiple Group Structural Equation Model for Four Racial/Ethnic Groups



Note: χ^2(df)= 4132.66 (3554), *p*=.000. CFI = .989; TLI = .990; RMSEA = .018 (CI = .015-.020).
Unstandardized path coefficients are equal across groups. Range of standardized coefficients across groups bolded in parenthesis.
= path statistically significant at .01 level; = path not statistically significant.
T1= Time 1 measurement; T2=Time 2 measurement.

Table 7.

Standardized Parameter Estimates for Final Multiple Group Structural Equation Model For Four Racial/Ethnic Groups

	Standardized Parameter Estimates			
Structural Path	African American	Hispanic/ Latino	White	Native American
Engagement T1 → Engagement T2	.616	.591	.588	.566
Optimism T1 → Engagement T2	- .026	- .022	- .020	- .019
Academic Relevance → Engagement T2	- .004	- .003	- .003	- .003
Optimism-T1 → Optimism T2	.332	.347	.312	.322
Academic Relevance → Optimism T2	.132	.106	.123	.117
Gender → Engagement T2	- .018	- .018	- .017	- .015
Free/Reduced Lunch → Engagement T2	- .018	- .013	- . 023	- .019
Retention → Engagement T2	- .114	- .118	- .096	- .087
Gender → Optimism T2	.083	.101	.099	.088
Free/Reduced Lunch → Optimism T2	- .048	- .041	- .077	- .065
Retention → Optimism T2	- .170	- .211	- .175	- .165
Academic Relevance WITH Optimism T1	.564	.578	.512	.526
Academic Relevance WITH Engagement T1	.513	.506	.512	.487
Optimism T1 WITH Engagement T1	.377	.441	.410	.447

Note: T1= Time 1 measurement; T2=Time 2 measurement

the four racial/ethnic groups. Table 7 presents the standardized path coefficients for each group. It is important to remember that although the standardized values vary slightly across groups, the unstandardized values were constrained equal and are therefore identical for the four groups. For the sake of simplicity, the measurement part of the model is omitted from the Figure 4.

Because the multiple group invariance tests indicated that the relationships among variables did not differ significantly for students of different race/ethnic groups, the overall results of the final model are very similar to those of the initial whole-group SEM described above. As a whole, the final model explained 34% of the variance in the Engagement at Time 2 outcome variable. However, the mediational pathway hypothesized in the model was not supported. The direct path between Academic Relevance Time1 and Engagement Time2 was not significant. The hypothesized mediating variable, Optimism Time1, did not significantly predict the dependent variable, Engagement Time2. Only one portion of the hypothesized mediational pathway was significant: Academic Relevance at Time1 significantly and positively predicted Optimism at Time 2. The more students perceived their teachers as using relevance-focused strategies at Time 1, the higher the level of future-oriented optimism they reported at Time 2. Although this path was significant, standardized parameter estimates for the path ranged from .106 for the Hispanic/Latino model to .132 for the African American model, indicating a weak effect. Overall, these findings indicate that although teachers' use of academic relevance strategies had a significant, but weak, positive effect on students' subsequent optimism, neither the hypothesized predictor (academic relevance strategies) nor the hypothesized mediator (optimism) significantly predicted the focal outcome of students' subsequent engagement.

Among the control variables, previous grade retentions were significantly, but weakly, associated with lower levels of optimism (standardized parameter estimates [SPE] range from

.16 to .21) and engagement (SPE: .09 to .12). Gender significantly and weakly predicted future-oriented optimism: being female was associated with greater optimism (SPE: .08-.10). Receipt of free or reduced meals was significantly, but weakly, associated with lower levels of optimism (SPE: .04-.07). Neither gender nor free/reduced lunch status were significant predictors of engagement. Overall, the strongest predictors of students' optimism and engagement at Time 2 were the respective Time 1 measures of these variables (SPE: .31-.35 and .59-62, respectively).

CHAPTER V
DISCUSSION

This final chapter provides a review and discussion of the findings of the study. First, findings related to the measurement of latent constructs, tests of latent factor mean differences across racial/ethnic groups, and tests of the hypothesized conceptual model are interpreted and discussed. Then, overall strengths and limitations of the research are presented. The chapter concludes with a discussion of the implications of the study and possible directions for future research.

Measurement of Latent Constructs

The study first assessed the quality of data collected using scales related to academic relevance, optimism, and school engagement and included an assessment of measurement invariance across racial/ethnic groups. Results revealed that one of the three scales (i.e., Academic Relevance) displayed full measurement invariance, and partial measurement invariance was supported for the other two scales (i.e., Optimism, Engagement). The evidence of noninvariance for the Optimism and Engagement scales suggests that youth of different racial/ethnic groups interpreted, conceptualized, and/or simply responded to some items differently. However, post-hoc analyses suggest that, from a practical perspective, all three scales can be treated as invariant. A discussion of the statistical differences is presented first, followed by a discussion of the practical differences and implications.

The Academic Relevance scale displayed full scalar measurement invariance: the configural structure, path loadings, and thresholds were fully invariant across the four racial/ethnic groups. This indicates that adolescents with equivalent latent construct scores responded similarly to items across ethnic/racial groups. A finding of full measurement invariance indicates the scale performs equivalently across the race/ethnic groups tested, which permits further group level comparison of means (Cheung & Rensvold, 2002).

The Optimism measure displayed configural and metric (i.e., factor loading) invariance, but results revealed noninvariance among the thresholds of six items. Examination of threshold patterns across racial/ethnic groups revealed that thresholds for Caucasian students on these items were lower than those of African American students, and in many cases, lower than those of the other two racial/ethnic groups. These results suggest Caucasian students may have a propensity to respond more strongly to these items, endorsing the strongly positive response option more so than other race/ethnicities, despite having the same latent factor mean (Sass, 2011). That is, the same amount of the construct results in a higher response value (e.g., *strongly agree* instead of *agree*). It is also possible that members of different racial/ethnic groups interpreted response option labels differently when responding to items (Chen, 2008).

The Engagement measure displayed configural invariance, but results revealed noninvariance for one factor loading. The unstandardized factor loading on one item was substantially lower for Hispanic/Latino students than for the other three race/ethnic groups. This finding suggests that the idea captured by the indicator (i.e., enjoyment of going to school) contributes less to Hispanic/Latino's latent engagement score than it does for students of other racial/ethnic groups. This difference may be the result of a conceptualization of engagement among Hispanic/Latino students that differs from that held by other students (Chen, 2008; Sass,

2011). In other words, enjoyment of school may not be as important to Hispanic/Latino students' emotional connection to school as it appears to be for students of other race/ethnicities. In addition, noninvariance was indicated for thresholds associated with three items. An examination of the thresholds revealed the same pattern for these items as was seen for the Relevance measure. That is, the thresholds for Caucasian students on these items were lower than those of African American students, and in many cases, lower than the other two racial/ethnic groups. As such, similar conclusions can be drawn regarding the possible sources of these differences.

A key motivation underlying the testing of measurement invariance is the desire to conduct tests of substantive hypotheses and group differences with greater confidence in the validity of the measures. However, researchers (e.g., Byrne, 2012) have suggested that the practical effect of statistical noninvariance on groups' latent factor means is likely minimal if the extent of the noninvariance is relatively small; in such cases, modeling the sources of noninvariance is not required (Sass, 2011). Following the current recommendations in the literature (Chen, 2008; Sass, 2011), this study examined the practical impact of noninvariance on group latent factor means for the Optimism and Engagement scales. As alluded to earlier, results of post-hoc analyses (described fully in Appendix C) indicated that the statistical noninvariance did not translate into practical differences in conclusions regarding group latent means, suggesting that the influence of noninvariance can be considered trivial. As a result, the Optimism and Engagement scales may be considered to have demonstrated invariance from a practical standpoint. This finding suggests that it may be reasonable to conduct tests of substantive hypotheses and group level means without modeling the noninvariance between groups. That is, the study found that the three scales demonstrated sufficient measurement invariance to permit cross-group comparisons on each of the three latent variables.

This dissertation is the first study to test measurement invariance across racial/ethnic groups using these three scales from the School Success Profile (SSP) instrument. Given the quality of the sample and the number of racial/ethnic groups tested, the study suggests the SSP measures can be used with confidence across the tested groups. The study's findings related to the engagement measure are consistent with SSP developers' initial examination of the *School Satisfaction* scale (Bowen et al., 2005) and with the small number of studies that examine measurement equivalence of other engagement scales. For example, using data drawn from the Maryland Adolescent Development in Context Study (MADICS), Wang and colleagues (2011) found measurement invariance for African American and Caucasian students on measures of behavioral, cognitive, and emotional engagement. Using measures of behavior and psychological engagement from the National Educational Longitudinal Study of 1988 (NELS:88), Glanville & Wildhagen (2007) similarly found measurement equivalence across African American, Asian, Hispanic/Latino, and Caucasian students. The MADICS emotional engagement measure and the NELS:88 psychological engagement measure were conceptually similar to a subset of the current study's measure of emotional engagement, specifically those items related to the quality of teacher and peer relationships.

The existing literature regarding the measurement of academic relevance and optimism is extremely limited. Although psychometric properties have been established in previous studies for most SSP scales (Bowen et al., 2005), the Academic Relevance and Optimism scales were added during a 2008 revision of the SSP and psychometric properties had yet to be established in the published literature. Few measures of optimism or academic relevance exist. As such, the current study makes a substantial contribution to our ability to measure these

constructs across diverse groups; the inclusion of Native American students is a unique contribution to the literature.

Racial/Ethnic Group Differences in Academic Relevance, Optimism, and Engagement

The study examined whether there were latent mean differences in the three constructs (i.e., relevance, optimism, engagement) across racial/ethnic groups. In terms of school engagement, prior research has not reflected consensus on whether levels of engagement differ by race/ethnicity. Some studies have found that racial/ethnic minority youth report higher levels of engagement than Caucasian students (Johnson et al., 2001; Shernoff & Schmidt, 2008), while some have found lower levels of engagement among minority youth (Johnson et al., 2001; Woolley & Bowen, 2007; Yazzie-Mintz, 2007; 2010), and yet other studies have found no racial/ethnic differences (Marks, 2000). Because the majority of these studies compared only Caucasians and African Americans, comparatively little is known about the engagement levels of Hispanic/Latino and Native American students and the extent to which these levels may resemble or differ from those of other racial/ethnic groups. The current study's ability to compare four racial/ethnic groups within the same sample expands the engagement literature by going beyond a simple comparison of racial/ethnic minority students and Caucasian students. The validity of these comparisons is strengthened greatly by the establishment of measurement invariance across groups, as described in the previous section.

In the current study, Caucasian and Hispanic/Latino students reported significantly higher levels of emotional engagement than African American students. This finding is consistent with the work of Johnson and colleagues (2001), who analyzed data from a national representative sample of adolescents (Add Health). Using a measure similar to the one used in the current study, Johnson et al. (2001) found no difference in engagement between Hispanic/Latino and

Caucasian students, but significantly lower levels of engagement among African American students as compared to Caucasians and Hispanic/Latinos. In the current study, Native American students' emotional engagement levels did not differ significantly from any other racial/ethnic group. This finding makes a substantial contribution to our very limited knowledge of Native American students' perceptions of their schooling experience. Historically, the small or nonexistent presence of Native American students in study samples has generally precluded reporting data for this group.

Optimism. Although some studies suggest that poverty and low socio-economic status are associated with pessimism (Nurmi, 1991), more recent analysis have found the opposite (McCabe & Barnett, 2000). Among the current study's generally low-income sample, mean levels of optimism were generally high across racial/ethnic groups. However, African American students reported higher levels of future-oriented optimism than all other groups and Native American students reported higher levels than Caucasian students. Because much of what is known about optimism among adolescents comes from studies of Caucasian individuals, very the current literature offers little guidance regarding expected potential differences across racial/ethnic groups (Carver et al., 2010). However, the current study's findings are consistent with other studies (e.g., Graham, 1994; van Laar, 2000) that report higher levels of aspirations and self-efficacy (i.e., constructs that are conceptually related to optimism) among racial/ethnic minority students.

Optimism is an adaptive motivational belief that can act as a protective factor and buffer against structural barriers to success (e.g., poverty, racial/ethnic discrimination; Meece & Kurtz-Costes, 2001), current stress (e.g., grief; Carver et al., 2010), and historical trauma (Denham, 2008). These risk factors are especially relevant in the context of the current study, in which the

majority of African American and Native American students are from low-income families, one-third of these students report experiencing the loss of a close friend or family member in the last year (Rural Adaptation Project [RAP], unpublished data, 2013) and youth are socialized in a community context with a long history of trauma (Lowery, 2010). As such, explanations for higher levels of optimism among African American and Native American students in the current sample may be found in the influence of socializing agents such as parents, extended kin, churches, and tribal members who encourage and foster optimism as a coping strategy (Denham, 2008; McCabe & Barnett, 2000).

The finding of higher optimism, yet lower engagement, for African American students is similar to patterns seen in other studies in which African American students report higher educational aspirations yet lower academic engagement and performance (e.g., Kao & Tienda, 1998; Mickelson, 1990; van Laar, 2000). Researchers debate the possible explanations for this phenomenon. Mickelson (1990) hypothesized that abstract attitudes (e.g., generalized optimism) are poor predictors of outcomes for African American students, as compared to concrete attitudes (e.g., perceived discrimination and opportunities) that are derived from daily experiences in one's family and community. Van Laar (2000) suggested a similar explanation: optimism and aspirations may not translate into outcomes because they are conditioned by perceptions of barriers to success (e.g., discrimination). In light of these hypotheses, assessing discrimination and other potential barriers to success may be important to better understanding the high optimism-low engagement paradox in the current study's findings.

Academic relevance. Few studies have examined racial/ethnic differences in student perceptions of teachers' use of relevance strategies. One such study (Rose et al., 2012) found that African American students were more likely than Hispanic/Latino or Caucasian students to

report that their teachers frequently used strategies to connect class content to future careers. Consistent with the work of Rose and colleagues (2012), African American students in the current study were significantly more likely than Caucasian and Hispanic/Latino students to report that their teachers used relevance-related strategies. No other significant differences across groups were found in students' perceptions of relevance strategies. Given the scarcity of literature in these areas, the current study makes a substantial contribution to our understanding of optimism across groups and how students from different racial/ethnic backgrounds perceive teachers' use of relevance strategies. However, additional research is needed to further unpack race/ethnicity differences.

Conceptual Model

Although some research suggests that teachers' use of relevance strategies can positively influence students' school engagement (e.g., Orthner et al., 2013), the processes by which this influence occurs is not clear. The current study used longitudinal data to test a conceptual model that hypothesized a series of direct and indirect relationships between teachers' use of relevance strategies, students' future-oriented optimism, and school engagement. As a whole, the hypothesized conceptual model fit the data well and explained 34% of the variance in school engagement at Time 2. Tests of potential moderation by race/ethnicity found that the overall explanatory value of the model was not significantly different across groups.

However, many of the research questions related to the conceptual model did not bear out, specifically regarding the hypothesized predictors of school engagement. In the conceptual model, school engagement was hypothesized to be directly influenced by both academic relevance and future-oriented optimism. This hypothesis was not supported: neither of the substantive variables hypothesized to influence engagement (i.e., relevance and optimism)

demonstrated significant relationships over the one year period. The only significant predictors of school engagement at Time 2 were school engagement at Time 1 and previous grade retentions, both of which were included in the conceptual model as control variables. The findings for each of these hypothesized relationships are discussed below.

Relevance and engagement. The analysis did not reveal significant associations between teachers' use of relevance strategies and school engagement for the sample as a whole or any of the four racial/ethnic groups. The absence of a significant relationship is somewhat unexpected given the positive association in the existing literature between perceived relevance and school engagement (e.g., Crumpton & Gregory, 2011; Hardré et al., 2007). It is important to note, however, that the conceptualization of these variables in the current study's hypothesized model differs from previous research in two important ways. First, the majority of studies providing evidence for the relevance-engagement relationship focuses on students' perceptions of relevance rather than teachers' use of strategies intended to demonstrate relevance. That is, most studies conceptualize and measure relevance in terms of students' perceptions of whether school or a specific class is personally relevant to their current lives, their interests, or their futures (e.g., Crumpton & Gregory, 2011). Research that examines relevance in the same manner as the current study (i.e., in terms of teachers' use of relevance-focused instructional strategies) is in a nascent stage of development, and therefore empirical information is still rather limited.

This difference in conceptualization expands the literature and may have contributed to the discrepancy in results between previous studies and the current analysis. Specifically, this study's findings suggest that the relationship between relevance and engagement may be more nuanced than indicated by previous studies. In the investigation of other areas of school learning environments (e.g., belonging), research suggests that students' *perceptions* are more closely

related to outcomes than are more seemingly objective measures (e.g., Goodenow, 1993). This phenomenon may also apply to the concept of academic relevance: students' *perceptions* of whether school is relevant to their lives may be more important in shaping students' engagement than teachers' use of relevance strategies. That is, perhaps it is not necessarily what teachers are doing in their instruction that directly influences engagement, but rather, how students feel about whether school is instrumental to their lives and futures. The inclusion of both variables (i.e., teachers' use of strategies, students' perceptions of relevance) in future studies could test this hypothesis and help tease apart the nature of these relationships.

The second important difference in conceptualization relates to the dependent variable. Most previous studies have focused either cognitive or behavioral engagement (e.g., Greene et al., 2004), rather than emotional engagement. Only one quantitative study has examined the impact of teachers' use of relevance strategies on emotional engagement (Orthner et al., 2013). Unlike the present study, the measure employed by Orthner and colleagues focused solely on students' affective responses (e.g., excitement, enjoyment) and demonstrated a strong relationship with relevance strategies. The concepts of belonging and student-teacher relations were not included in their conceptualization and operationalization of emotional engagement.

The distinction in the conceptualization and measurement of engagement is important because it is plausible that teachers' use of relevance strategies influences the various components of school engagement differently. Relevance strategies may influence students' behavioral engagement (e.g., Green et al., 2004) and aspects of their emotional engagement (e.g., excitement, enjoyment; Orthner et al., 2013), but the influence of these instructional strategies may not extend to other aspects of emotional engagement such as students' feelings of belonging or student-teacher relationship quality. If this is the case, the failure of the current study to detect

a relationship between relevance and emotional engagement may be an artifact of the measure used.

These instrumentation nuances are reflective of the current state of the literature regarding measuring engagement. Although researchers generally agree that engagement is a multidimensional construct including behavioral, cognitive and emotional aspects, there is very little consensus on the best measures for each component. Measurement of engagement is further complicated by three factors: (a) there is currently little agreement on the delineation of the content of the three components; (b) each type of engagement combines several constructs (e.g., relationship quality, belonging, interest) that are often measured individually in other studies; and (c) the same scale items are often used to represent different subtypes of engagement across studies (Appleton et al., 2006; Fredricks et al., 2004). These measurement challenges may be best addressed in future studies by inclusion of a more comprehensive measure that incorporates the various components, allowing for a more nuanced examination of the influences on engagement.

Relevance and optimism. Only one part of the substantive conceptual model was supported: teachers' use of relevance strategies at Time 1 was associated with greater optimism at Time 2, even after controlling for optimism levels at Time 1. This finding expands our limited understanding of the association between these constructs. To date, the empirical literature in this area has not reflected consensus on the nature of the relationship. Although some previous studies (e.g., Perry, 2008) found a positive association between perceptions of relevance and expectations for future success (i.e., optimism) among racially/ethnically diverse students from low-income backgrounds, other studies with predominately middle-class Caucasian students (e.g., Greene et al., 2004) have not supported this finding. The current study adds support to the

notion that academic relevance (more specifically, teachers' use of relevance strategies) is associated with higher levels of optimism over time. Further, this study found no evidence of moderation by race/ethnicity. Rather, teachers' use of relevance strategies positively predicted subsequent optimism for all four racial/ethnic groups in the sample. This finding suggests the universality of the importance of perceiving school as relevant, and that cultivation of this perception may have an influence on early adolescents' beliefs and attitudes about their potential future success. Because a positive future orientation may be especially important for students who encounter structural barriers to academic and future success (e.g., poverty, discrimination; McCabe & Barnett, 2000; Meece & Kurtz-Costes, 2001), classroom-based strategies to increase optimism may be especially appropriate for schools serving these populations.

However, it is important to recognize that, although significant, the strength of the relationship between relevance strategies and optimism in the current study was quite weak. Much of the variance in students' future oriented optimism remained unexplained by the study's conceptual model. Other contextual sources of optimism, unmeasured in the current study, may influence optimism significantly more than the relevance strategies used by classroom teachers. Parents and other family members can be an important influence on optimism among early adolescents (McCabe & Barnett, 2000). Social institutions such as churches and tribal organizations may also exert a positive influence on the development of optimism among youth. These institutions may be especially relevant in the context of the current study in which over one-third of the sample was Native American, nearly half of all respondents (across all races/ethnicities) reported going to a place of worship once a week, and nearly all respondents indicated that their religious faith gave them strength (RAP, unpublished data, 2013).

Optimism and engagement. In contrast to previous research (e.g., Van Ryzin, 2011; Van Ryzin et al., 2009), the analysis did not reveal significant associations between students' future-orientated optimism and their engagement in school over time. One possible explanation for the discrepancy between this analysis and the work of Van Ryzin and colleagues relates to differences in the samples used. Van Ryzin and colleagues used a middle-class, predominately Caucasian sample that included both middle and high school students and rural and non-rural students. The racial/ethnic, socioeconomic, rurality, and/or age differences between the samples may contribute to the difference in findings. Future investigations would benefit from the exploration of these variables as potential moderators of the relationship between optimism and school engagement. Similar to the discussion of relevance and engagement above, it is also important to consider differences in the measurement of engagement. Van Ryzin and colleagues (2009; 2011) conceptualized emotional engagement as being limited to affective reactions (e.g., happiness, boredom, excitement) rather than the broader conceptualization used in the current study. Further, Van Ryzin combined behavioral and emotional subscales into one engagement score, thus precluding an examination of optimism's effect on emotional engagement alone.

Control variables. As discussed above, numerous differences between study conceptualization, operationalization, and samples may contribute to the discrepancy between the current study's findings and those from previous studies. The contrasting findings also may be due in part to the fact that previous research has often failed to control for previous levels of optimism and engagement. In the current study, the strongest predictors of optimism and engagement at Time2 were their respective measures at Time1, indicating their central importance in explanatory models of student perceptions.

Likewise, students' history of grade retention is rarely included as a control variable in studies of engagement, despite the known association between the variables (Li & Lerner, 2011; Woolley & Bowen, 2007). Among the current sample, a history of grade retention significantly predicted lower engagement and lower levels of optimism. The inclusion of important control variables in the model tested in the current study may explain differences in findings and suggests that this study's findings may be more valid than those of previous studies that did not account for these important control variables.

Overall considerations for the model. The paths hypothesized in the conceptual model were informed by both possible selves theory and expectancy-value theory, both of which posit that students' thoughts and beliefs about their future (i.e. optimism) should be expected to influence their engagement in school. However, these theoretically-indicated relationships were not supported empirically among this study's sample of early adolescents. The study found although teachers' use of relevance strategies was associated with higher levels of optimism, increased optimism did not translate into differences in students' emotional engagement in school.

In light of the study findings, the appropriateness of these theories for understanding the engagement of low-income, racially/ethnically diverse early adolescents might be questioned. However, several possibilities should be considered. First, possible selves and expectancy-value theory refer to engagement broadly and do not explicate the expected relationships between antecedent variables and each component or dimension of engagement. As mentioned earlier, the majority of empirical research in this area has focused on behavioral and cognitive engagement, rather than emotional engagement. The findings of this study, if replicated with other samples,

may suggest the need for elaboration of the theories to delineate the potential for different outcomes for the various aspects of engagement.

Second, the potential impact of conditions in the context should be considered. For example, recent thinking among possible selves theorists posits that focusing attention on the future (e.g., by encouraging students to think about how they might use a particular academic skill in a future career) might result in an energizing affective response (e.g., optimism) but may not translate into differences in current thinking or behavior if facilitating conditions are not in place (Oyserman & James, 2011). One important facilitating condition is the *felt connection to the current self* (Oyserman & James, 2011, p. 135): individuals' current feelings and behavior are more likely to be influenced their thoughts about the future when the imagined future feels closely connected to, rather than disconnected from, the present. In examining this proposition as it relates to the current study, the developmental characteristics of early adolescents (i.e., middle school students) must be considered. Although early adolescents are increasingly capable of envisioning the future and conceptualizing the future implications of current behavior, this is an emerging developmental skill (Erikson, 1968). The high level of optimism observed across all racial/ethnic groups, combined with the absence of a significant relationship with current school engagement, suggests the possibility of a weak *felt connection.* Early adolescents may hold a naïve, perhaps unrealistic, optimism about the future that has little connection to the present. The proposition by Oyserman & James (2011) suggests that cultivating optimism may be insufficient to influence engagement; additional strategies to make the future feel closely connected to the present may be needed.

Third, given the context from which the sample was drawn, the concept of identity safety may be particularly important to students' emotional engagement as it was measured in this

study. Identity safety (Marcus, Steele, & Steele, 2000) is the extent to which the school environment conveys the message to students "that their social identity is not a barrier to success in the classroom, and that they are welcomed, supported, and valued whatever their background" (Davies, Spencer, & Steele, 2005, p. 278). Identity safe schools are ones in which early adolescents' racial-ethnic identity is recognized as a strength and its development is actively supported. Given the rural and majority-minority context of the current study, it is important to note that the racial/ethnic make-up of the teaching and administrative staff in the study counties closely mirrors that of the student body. This context may foster the creation of identity safe environments in which students feel a sense of belonging and a connection with their teachers. Other researchers have found that role model and mentoring connections with teachers are especially important for low-income and rural students of color (Griffin, Hutchins, & Meece, 2011). Because the engagement measure focused heavily on students' sense of belonging and their relationships with teachers, it is plausible that this particular feature of the educational context, not captured in the conceptual model, may be central to students' emotional engagement. Information on these and other aspects of the school climate and teaching culture in the study setting would have strengthened the study's conceptual model and ability to more fully understand the nature of student engagement in this context.

Strengths and Limitations of the Research

The findings of the study should be considered in light of several study strengths and limitations. As discussed earlier, although substantial literature suggests that school engagement is influenced by the extent to which students perceive school as personally relevant, few studies have specifically examined teachers' use of relevance strategies. The current study contributes to this small, but growing body of literature. One strength of study lies in its test of a theoretically

and empirically informed conceptual model that attempted to identify the explanatory pathway underlying the relationships observed in previous studies of relevance and engagement. Although the results did not support the hypothesized pathway, the findings nonetheless add to our understanding of these relationships. Further, the study results highlight the potential importance of relevance strategies in influencing future oriented optimism and the consistency of this relationship across varied racial/ethnic backgrounds.

One of the greatest strengths of the study is its use of a large, representative, racially/ethnically diverse rural sample of early adolescents. To date, few studies of school engagement, optimism, and academic relevance have focused on rural populations and those that do generally do not use racially or ethnically diverse samples. Nearly all previous studies of school engagement have been limited to samples that consist exclusively or predominately of one racial/ethnic group. The majority of studies have been conducted with primarily non-rural Caucasian or African American samples. Native American early adolescents are particularly under-represented in the literature. Moreover, the specific variables, measures, and conceptual models vary greatly across studies. Combined, these characteristics have limited our ability to draw conclusions about similarities or differences in the experiences of students. The current study advances the state of the literature by using a rural sample of early adolescents that includes substantial numbers of four racial/ethnic groups: African Americans, Caucasians, Hispanic/Latinos, and Native Americans. The sample permits the investigation of unanswered questions from the literature, specifically questions regarding cross-cultural differences in the experiences of early adolescents in schools. The study specifically addressed two such questions by investigating whether measures operated equivalently across groups and whether the nature of relationships between constructs varied for students from different racial/ethnic backgrounds.

Finally, another important strength of this study is the advanced latent variable data analytic procedures employed. Despite the common use of scales hypothesized to measure latent variables, latent variable analysis methods are underutilized in the engagement, optimism, and academic relevance literatures. Among studies that do use latent variable analysis, the most rigorous methods are not consistently applied. For example, ordinal non-normally distributed data (e.g., data obtained using Likert scales) often are modeled inappropriately as continuous, normally distributed data. Few studies of measurement invariance in the social work literature appear to have used the necessary procedures to appropriately address issues arising from categorical variables; as such, part of the value of the current study was to demonstrate the process. The analytic approach used in the current study allowed for model testing while employing the most current and rigorous methods to appropriately model and analyze the data, testing for both measurement and structural invariance. Studies testing both measurement and structural invariance are scarce, but are needed in the literature (Sass, 2011).

Several limitations of the current study should also be considered. Although the study extends the predominately cross-sectional literature by using two waves of data to test relationships over time, the use of only two waves of data is also an important limitation. With only two time points, the study did not have sufficient waves of data for a rigorous test of mediation. For mediation models with a single mediating variable, three waves of data are needed to fully assess direct and indirect effects while controlling for prior levels of each variable (Cole & Maxwell, 2003). Controlling for the Time 1 measures of both the hypothesized mediator and the dependent variable makes this study more rigorous than the cross-sectional mediation studies that permeate the literature. However, the test of mediation in the current study was based on an assumption of stationarity (i.e., an assumption of similar relationships between

two variables at different times; Cole & Maxwell, 2003). That is, it was assumed that the relationship modeled in the analysis between the mediator (optimism) at Time1 and the outcome (engagement) at Time 2 would be equal to the relationship between the mediator at Time 2 and the outcome at Time 3, had Time 3 data been available. However, this assumption may not hold, and with only two waves of data, the assumption cannot be tested. Thus, strong inferences regarding causal mechanisms based on the results of this study should be avoided (MacKinnon, 2008). An important future study would build on this dissertation by testing the conceptual model with three waves of data.

Future studies would also benefit from the inclusion of additional measures that would permit a more complete test of the conceptual model suggested by theory and previous empirical research. For example, only one component of engagement (i.e., emotional) was measured in the current study. Although a somewhat similar scale was used in a previous study (e.g., Johnson et al., 2001), the majority of studies have focused on either cognitive or behavioral engagement. As discussed above, it is possible that relevance and optimism may influence the various components of engagement differently. A more complete conceptual model ideally would include all three components of engagement to better understand the potential influence of relevance and optimism on each aspect of students' engagement.

It is also important to note that this study used global, rather than domain specific (i.e., school subject) measures. That is, students were asked about their school or their teachers *in general* rather than about a specific domain or subject area. However, by adolescence, many students are developing differentiated views of optimism, relevance, and engagement. It is plausible that domain-specific measures, unavailable in the RAP dataset, would illuminate a different pattern of relationships than those seen in this analysis.

A final limitation concerns the academic relevance measure. The measure asked students to report on their perceptions of the extent to which teachers encourage students to think about the future, and the extent to which teachers relate classroom lessons to the real world, student interests, student experiences, and potential future jobs and careers. The measure does not necessarily tap into teachers' in-class instructional strategies. Although students may have responded in reference to their teachers' behaviors in class, it is also possible that students could have answered in reference to broader interactions with teachers and possibly other adults at school (e.g., coaches). Future use of these items could benefit from cognitive testing to better understand how students interpret the items and response options. Moreover, this measure focuses on students' perceptions of teachers' behaviors. The inclusion of another source of data (e.g., teachers' reports of their use of relevance strategies, classroom observations of instructional strategies) could strengthen the measure of this construct and reduce the potential problem of common method variance.

Implications for Practice and Future Research

The findings of the current study have three main practical implications. First, study results provided evidence regarding the validity and reliability of the three School Success Profile scales. Hence, the study's results support the use of these scales to measure perceptions of relevance, optimism, and school engagement among racially/ethnically diverse rural early adolescents. Further, establishment of measurement invariance indicates that cross-group comparisons are indeed be appropriate when using these measures. Optimism and school engagement (and to a lesser extent, perceptions of academic relevance) are common targets of many prevention and intervention programs implemented with adolescents in school and community-based programs. Evaluating such programs and detecting real change in targeted

constructs depends, in part, on using measures that perform well psychometrically. This study contributes to these intervention and evaluation efforts by validating scales that may be used to measure targeted constructs.

Second, this study highlights the potential importance of academic relevance strategies in increasing optimism among low-income and racial/ethnic minority students. As a potential protective factor (Snyder et al., 1997; Worrell & Hale, 2001), future-oriented optimism is a logical target for school-based intervention efforts. A recent meta-analysis highlighted the need for research that examines the extent to which interventions can influence optimism (Alarcon et al., 2013). Promising avenues for future research include: (a) exploration of how, and under what conditions, use of academic relevance strategies influences students' optimism about the future, (b) replication and refinement of existing interventions that support teachers' use of relevance focused instructional strategies (e.g., CareerStart; Orthner et al., 2013), (c) the development of additional strategies that promote students' perceptions of school relevance, and (d) identification of other malleable factors in the home, community, and school contexts that positively influence optimism.

Because a positive future orientation may be especially important for students who encounter structural barriers to success (e.g., poverty, discrimination; McCabe & Barnett, 2000; Meece & Kurtz-Costes, 2001), strategies to increase optimism among low-income and racial/ethnic minority students can be clearly aligned with the goals of school social workers. Several opportunities exist for school social workers to lead and contribute to efforts to foster students' perception of school relevance and their future-oriented optimism. School social workers' familiarity with the home and community environments of students, combined with their long-standing role of supporting classroom teachers (Massat, Constable, McDonald, &

Flynn, 2009), makes social workers well positioned to support teachers' efforts to increase the perceived relevance of content to students' lives and futures. Such efforts may be especially important in rural, low-income schools where teachers are often perceived by students of color as an important source of information about possibilities for the future (Griffin et al., 2011). Social workers also could collaborate with teachers, counselors, and career development specialists to infuse appropriate and culturally congruent messages regarding relevance and future orientation throughout a school's environment. School social workers can incorporate relevance and optimism concepts into their everyday interactions with students and school staff. Social workers can also engage families in conversations about students' futures and how school connects to those futures.

Finally, the study highlights the need for further research investigating school engagement. Targeting aspects of the classroom environment (e.g., teacher behaviors, curriculum, climate) and understanding how students perceive these experiences may offer the possibility of positively influencing student engagement and in turn, other developmental outcomes (Goodenow, 1993). Towards this end, use of person-centered approaches such as latent profile analysis may prove fruitful. Wang & Peck's recent work (2013) in this area identified five distinct engagement profiles that were predictive of differences in high school dropout, college attendance, and mental health. Important future work could examine the interrelations of these profiles and with other variables, such as teachers' instructional strategies and students' future-orientated optimism. These investigations promise to help us better understand the complexity of students' school experiences and to design specifically targeted and nuanced interventions.

APPENDIX A: SCHOOL SUCCESS PROFILE ITEMS

Items in the SSP *Academic Relevance* Scale

Response options: Strongly Disagree; Disagree; Agree; Strongly Agree

S11c. My teachers help me relate what I am learning in the classroom to the real world.
S11d. My teachers help me see the value of what I am learning in the classroom.
S11e. My teachers help me relate what I am learning in the classroom to my own experiences and interests.
S11h. My teachers help me relate what I am learning in the classroom to potential jobs and careers.
S11k. My teachers encourage me to think about my future as an adult.

Items in the SSP *Success Orientation* Scale

Response options: Strongly Disagree; Disagree; Agree; Strongly Agree

S21a. When I think about my future, I feel very positive.
S21b. I have a clear image of myself being successful in life.
S21c. I know how I don't want my life to turn out.
S21d. I have a good sense of what it takes to be successful as an adult.
S21e. I am on the "right track" for future success.
S21f. I try to make good choices to increase my chances for a good future.
S21g. I see a strong connection between success in school and success in life.
S21h. I am prepared to work hard to have a good life.
S21i. I am confident that I have what it takes to be successful in life.
S21l. I see myself accomplishing great things in life.

Items in the SSP *School Satisfaction* Scale

Response options: Not Like Me, A Little Like Me, A Lot Like Me

S13a. I enjoy going to this school.
S13b. I get along well with other students at this school.
S13c. I feel close to other students at this school.
S13d. I get along well with teachers at this school.
S13e. I am getting a good education at this school.
S13f. I feel like I belong at this school.
S13g. I am happy that I attend this school.

APPENDIX B: ITEM-LEVEL DESCRIPTIVE STATISTICS

Table 8.

Item-level Means and Standard Deviations for each Racial/Ethnic Group

		Mean (Std Dev)			
Factor	Item	African American	Hispanic/ Latino	White	Native American
Academic	11c	3.19 (.752)	3.14 (.643)	3.13 (.678)	3.12 (.740)
Relevance	11d	3.25 (.700)	3.22 (.583)	3.21 (.656)	3.22 (.701)
	11e	3.11 (.759)	3.11 (.628)	3.01 (.741)	3.05 (.754)
	11h	3.18 (.788)	3.11 (.624)	3.00 (.738)	3.06 (.761)
	11k	3.18 (.873)	3.18 (.737)	3.12 (.772)	3.19 (.801)
Optimism	21a	3.55 (.667)	3.33 (.684)	3.43 (.658)	3.48 (.659)
Time 1	21b	3.54 (.666)	3.32 (.668)	3.41 (.681)	3.53 (.651)
	21c	3.39 (.881)	3.28 (.754)	3.34 (.867)	3.37 (.879)
	21d	3.48 (.733)	3.31 (.593)	3.37 (.639)	3.46 (.651)
	21e	3.34 (.710)	3.26 (.634)	3.30 (.663)	3.32 (.731)
	21f	3.48 (.683)	3.40 (.592)	3.48 (.579)	3.48 (.621)
	21g	3.44 (.715)	3.33 (.678)	3.30 (.678)	3.39 (.662)
	21h	3.54 (.674)	3.50 (.592)	3.50 (.605)	3.54 (.612)
	21i	3.54 (.667)	3.41 (.595)	3.46 (.617)	3.53 (.615)
	21l	3.64 (.632)	3.47 (.593)	3.53 (.618)	3.61 (.606)
Optimism	21a2	3.58 (.705)	3.46 (.675)	3.39 (.720)	3.43 (.726)
Time 2	21b2	3.55 (.717)	3.42 (.681)	3.39 (.685)	3.44 (.737)

	21c2	3.38 (.917)	3.17 (.887)	3.35 (.878)	3.32 (.941)
	21d2	3.49 (.694)	3.36 (.640)	3.38 (.664)	3.42 (.723)
	21e2	3.31 (.772)	3.27 (.660)	3.31 (.672)	3.29 (.769)
	21f2	3.48 (.707)	3.42 (.658)	3.40 (.629)	3.39 (.732)
	21g2	3.46 (.715)	3.36 (.656)	3.31 (.713)	3.36 (.742)
	21h2	3.55 (.685)	3.50 (.583)	3.49 (.634)	3.46 (.717)
	21i2	3.56 (.670)	3.40 (.632)	3.45 (.663)	3.44 (.714)
	21l2	3.66 (.626)	3.52 (.608)	3.52 (.632)	3.56 (.681)
Engagement	13a	2.24 (.680)	2.38 (.610)	2.27 (.693)	2.25 (.687)
Time 1	13b	2.39 (.642)	2.55 (.563)	2.55 (.595)	2.49 (.646)
	13c	2.24 (.728)	2.34 (.665)	2.35 (.681)	2.35 (.712)
	13d	2.31 (.699)	2.52 (.606)	2.55 (.613)	2.34 (.711)
	13e	2.54 (.619)	2.63 (.549)	2.63 (.579)	2.57 (.632)
	13f	2.23 (.790)	2.40 (.724)	2.41 (.730)	2.36 (.755)
	13g	2.28 (.752)	2.56 (.636)	2.48 (.705)	2.46 (.720)
Engagement	13a2	2.18 (.642)	2.32 (.605)	2.14 (.714)	2.16 (.712)
Time 2	13b2	2.47 (.618)	2.56 (.544)	2.53 (.561)	2.52 (.609)
	13c2	2.32 (.700)	2.34 (.674)	2.36 (.641)	2.41 (.660)
	13d2	2.28 (.680)	2.41 (.625)	2.43 (.654)	2.27 (.687)
	13e2	2.49 (.642)	2.55 (.597)	2.51 (.627)	2.46 (.645)
	13f2	2.14 (.786)	2.26 (.742)	2.30 (.750)	2.28 (.766)
	13g2	2.22 (.758)	2.35 (.705)	2.33 (.738)	2.32 (.762)

Table 9.

Polychoric Correlation Matrix of Items for African American Students (N=561)

Item	11C_1	11D_1	11E_1	11H_1	11K_1	13A_1	13B_1	13C_1	13D_1	13E_1	13F_1	13G_1
11D_1	0.70											
11E_1	0.67	0.73										
11H_1	0.63	0.70	0.72									
11K_1	0.64	0.64	0.63	0.64								
13A_1	0.26	0.28	0.26	0.29	0.30							
13B_1	0.27	0.26	0.16	0.17	0.26	0.28						
13C_1	0.20	0.22	0.20	0.17	0.25	0.36	0.49					
13D_1	0.31	0.32	0.34	0.34	0.32	0.50	0.51	0.34				
13E_1	0.35	0.42	0.31	0.31	0.29	0.48	0.34	0.32	0.54			
13F_1	0.24	0.29	0.28	0.30	0.34	0.63	0.33	0.33	0.50	0.58		
13G_1	0.29	0.33	0.35	0.32	0.34	0.69	0.34	0.36	0.52	0.61	0.83	
21A_1	0.36	0.35	0.36	0.29	0.34	0.07	0.28	0.19	0.22	0.32	0.19	0.19
21B_1	0.43	0.37	0.35	0.34	0.36	0.05	0.29	0.18	0.20	0.25	0.14	0.14
21C_1	0.27	0.27	0.28	0.25	0.28	-0.04	0.18	0.10	0.01	0.12	0.04	0.07
21D_1	0.45	0.43	0.43	0.41	0.47	0.10	0.35	0.23	0.20	0.28	0.14	0.17
21E_1	0.37	0.41	0.39	0.33	0.39	0.20	0.39	0.24	0.26	0.37	0.29	0.33
21F_1	0.42	0.38	0.39	0.34	0.41	0.16	0.31	0.19	0.17	0.28	0.18	0.21
21G_1	0.40	0.46	0.46	0.41	0.48	0.23	0.24	0.34	0.25	0.37	0.24	0.27
21H_1	0.40	0.42	0.40	0.34	0.44	0.11	0.36	0.21	0.19	0.32	0.16	0.25
21I_1	0.46	0.44	0.45	0.37	0.40	0.13	0.33	0.25	0.28	0.32	0.12	0.21
21L_1	0.48	0.42	0.39	0.37	0.48	0.17	0.35	0.18	0.25	0.38	0.21	0.28
13A_2	0.23	0.29	0.21	0.30	0.24	0.42	0.18	0.22	0.31	0.35	0.40	0.44
13B_2	0.20	0.14	0.09	0.22	0.14	0.14	0.40	0.23	0.31	0.26	0.19	0.25
13C_2	0.17	0.15	0.19	0.25	0.22	0.20	0.20	0.36	0.29	0.24	0.23	0.28

Table 9, continued

Polychoric Correlation Matrix of Items for African American Students (N=561)

Item	11C_1	11D_1	11E_1	11H_1	11K_1	13A_1	13B_1	13C_1	13D_1	13E_1	13F_1	13G_1
13D_2	0.15	0.19	0.11	0.19	0.10	0.20	0.27	0.22	0.40	0.32	0.25	0.35
13E_2	0.31	0.32	0.24	0.32	0.28	0.32	0.23	0.23	0.33	0.54	0.39	0.46
13F_2	0.17	0.18	0.15	0.20	0.11	0.28	0.22	0.23	0.30	0.34	0.42	0.46
13G_2	0.18	0.23	0.19	0.26	0.19	0.37	0.21	0.22	0.32	0.35	0.40	0.51
21A_2	0.36	0.30	0.24	0.27	0.32	0.08	0.22	0.15	0.21	0.37	0.15	0.20
21B_2	0.30	0.20	0.23	0.24	0.24	0.12	0.23	0.16	0.19	0.31	0.15	0.16
21C_2	0.19	0.08	0.13	0.12	0.17	0.02	0.15	0.09	0.11	0.16	0.08	0.08
21D_2	0.31	0.16	0.15	0.15	0.14	0.09	0.18	0.18	0.12	0.22	0.09	0.09
21E_2	0.22	0.16	0.15	0.13	0.16	0.13	0.26	0.13	0.19	0.34	0.16	0.19
21F_2	0.32	0.18	0.19	0.20	0.25	0.14	0.29	0.17	0.20	0.34	0.18	0.18
21G_2	0.30	0.23	0.24	0.20	0.21	0.12	0.22	0.16	0.17	0.39	0.18	0.17
21H_2	0.31	0.19	0.23	0.22	0.25	0.14	0.15	0.20	0.14	0.36	0.15	0.15
21I_2	0.31	0.21	0.24	0.15	0.17	0.11	0.25	0.18	0.18	0.37	0.17	0.19
21L_2	0.30	0.17	0.17	0.18	0.19	0.04	0.23	0.15	0.12	0.29	0.10	0.13

Table 9, continued

Polychoric Correlation Matrix of Items for African American Students (N=561)

Item	21A_1	21B_1	21C_1	21D_1	21E_1	21F_1	21G_1	21H_1	21I_1	21L_1	13A_2	13B_2
21B_1	0.84											
21C_1	0.54	0.64										
21D_1	0.76	0.79	0.61									
21E_1	0.68	0.67	0.47	0.68								
21F_1	0.73	0.73	0.57	0.74	0.70							
21G_1	0.70	0.72	0.54	0.72	0.70	0.75						
21H_1	0.69	0.74	0.56	0.73	0.72	0.77	0.73					
21I_1	0.74	0.72	0.55	0.76	0.74	0.75	0.81	0.78				
21L_1	0.76	0.77	0.56	0.74	0.70	0.72	0.76	0.84	0.78			
13A_2	0.15	0.09	0.03	0.15	0.19	0.14	0.19	0.13	0.13	0.19		
13B_2	0.22	0.17	0.11	0.18	0.20	0.20	0.15	0.23	0.19	0.28	0.36	
13C_2	0.21	0.14	0.10	0.11	0.17	0.11	0.23	0.24	0.17	0.27	0.43	0.58
13D_2	0.17	0.09	-0.01	0.09	0.12	0.13	0.12	0.18	0.16	0.14	0.44	0.48
13E_2	0.15	0.09	0.01	0.18	0.24	0.16	0.20	0.22	0.23	0.20	0.60	0.36
13F_2	0.10	0.05	-0.03	0.01	0.17	0.06	0.13	0.10	0.08	0.14	0.69	0.44
13G_2	0.15	0.10	-0.01	0.08	0.18	0.15	0.20	0.12	0.10	0.17	0.70	0.41
21A_2	0.43	0.37	0.13	0.32	0.38	0.37	0.34	0.37	0.39	0.41	0.20	0.33
21B_2	0.33	0.31	0.11	0.23	0.33	0.31	0.29	0.29	0.36	0.32	0.21	0.36
21C_2	0.19	0.17	0.25	0.15	0.16	0.15	0.23	0.15	0.16	0.23	0.07	0.16
21D_2	0.35	0.28	0.20	0.33	0.29	0.28	0.26	0.23	0.31	0.33	0.12	0.28
21E_2	0.33	0.24	0.09	0.29	0.37	0.31	0.27	0.27	0.31	0.31	0.19	0.37
21F_2	0.32	0.27	0.12	0.33	0.33	0.36	0.30	0.30	0.33	0.38	0.22	0.36
21G_2	0.31	0.23	0.14	0.30	0.38	0.32	0.38	0.29	0.36	0.30	0.25	0.29
21H_2	0.34	0.29	0.09	0.32	0.32	0.36	0.34	0.36	0.34	0.41	0.16	0.31
21I_2	0.31	0.29	0.11	0.27	0.35	0.37	0.31	0.34	0.39	0.40	0.17	0.33
21L_2	0.28	0.33	0.17	0.22	0.30	0.32	0.25	0.35	0.32	0.41	0.10	0.33

Table 9, continued

Polychoric Correlation Matrix of Items for African American Students (N=561)

Item	13C_2	13D_2	13E_2	13F_2	13G_2	21A_2	21B_2	21C_2	21D_2	21E_2	21F_2	21G_2	21H_2	21I_2
13D_2	0.43													
13E_2	0.44	0.56												
13F_2	0.50	0.51	0.61											
13G_2	0.49	0.50	0.60	0.83										
21A_2	0.29	0.32	0.38	0.27	0.19									
21B_2	0.39	0.27	0.40	0.32	0.20	0.90								
21C_2	0.19	0.17	0.17	0.12	0.09	0.60	0.58							
21D_2	0.26	0.27	0.22	0.15	0.09	0.81	0.81	0.63						
21E_2	0.29	0.35	0.32	0.24	0.20	0.76	0.78	0.48	0.76					
21F_2	0.35	0.34	0.34	0.21	0.21	0.78	0.81	0.55	0.78	0.79				
21G_2	0.27	0.34	0.41	0.28	0.28	0.77	0.77	0.49	0.73	0.76	0.81			
21H_2	0.34	0.31	0.33	0.23	0.18	0.79	0.81	0.61	0.77	0.71	0.80	0.78		
21I_2	0.37	0.28	0.36	0.28	0.19	0.80	0.83	0.55	0.80	0.76	0.80	0.78	0.83	
21L_2	0.31	0.26	0.27	0.22	0.12	0.81	0.86	0.56	0.81	0.70	0.79	0.79	0.85	0.86

Table 10.

Polychoric Correlation Matrix of Items for Hispanic/Latino Students (N=209)

Item	11C_1	11D_1	11E_1	11H_1	11K_1	13A_1	13B_1	13C_1	13D_1	13E_1	13F_1	13G_1
11D_1	0.74											
11E_1	0.68	0.64										
11H_1	0.69	0.62	0.63									
11K_1	0.71	0.58	0.62	0.67								
13A_1	0.30	0.29	0.33	0.19	0.18							
13B_1	0.32	0.21	0.27	0.28	0.11	0.39						
13C_1	0.11	0.09	0.18	0.12	-0.08	0.35	0.62					
13D_1	0.42	0.36	0.43	0.39	0.24	0.53	0.41	0.22				
13E_1	0.54	0.43	0.46	0.35	0.29	0.67	0.41	0.41	0.53			
13F_1	0.41	0.41	0.52	0.42	0.31	0.69	0.43	0.43	0.61	0.73		
13G_1	0.36	0.49	0.52	0.32	0.20	0.81	0.39	0.36	0.56	0.71	0.91	
21A_1	0.57	0.42	0.31	0.38	0.41	0.24	0.32	0.24	0.29	0.29	0.39	0.37
21B_1	0.40	0.52	0.27	0.27	0.38	0.24	0.25	0.19	0.28	0.24	0.31	0.35
21C_1	0.36	0.37	0.25	0.27	0.35	0.19	0.23	0.08	0.26	0.23	0.25	0.26
21D_1	0.36	0.42	0.27	0.29	0.34	0.25	0.33	0.26	0.32	0.33	0.37	0.39
21E_1	0.49	0.55	0.32	0.28	0.35	0.36	0.17	0.23	0.28	0.46	0.38	0.45
21F_1	0.48	0.53	0.20	0.39	0.38	0.29	0.35	0.23	0.26	0.20	0.36	0.32
21G_1	0.46	0.56	0.35	0.43	0.42	0.31	0.20	0.09	0.36	0.41	0.53	0.50
21H_1	0.45	0.49	0.28	0.33	0.39	0.31	0.23	0.06	0.27	0.35	0.34	0.36
21I_1	0.32	0.43	0.19	0.32	0.35	0.20	0.18	0.14	0.19	0.19	0.31	0.33
21L_1	0.51	0.55	0.29	0.35	0.41	0.18	0.27	0.12	0.18	0.21	0.31	0.29
13A_2	0.23	0.29	0.23	0.20	0.25	0.46	0.20	0.27	0.29	0.35	0.41	0.45
13B_2	0.16	0.15	0.22	0.16	0.08	0.22	0.36	0.28	0.20	0.26	0.41	0.28
13C_2	0.14	0.09	0.21	0.18	0.16	0.26	0.32	0.35	0.24	0.37	0.44	0.33

Table 10, continued.

Polychoric Correlation Matrix of Items for Hispanic/Latino Students (N=209)

Item	11C_1	11D_1	11E_1	11H_1	11K_1	13A_1	13B_1	13C_1	13D_1	13E_1	13F_1	13G_1
13D_2	-0.01	0.12	0.18	0.16	0.12	0.44	0.15	0.18	0.40	0.33	0.50	0.43
13E_2	0.16	0.19	0.26	0.19	0.22	0.39	0.21	0.18	0.15	0.46	0.47	0.45
13F_2	0.20	0.20	0.17	0.28	0.16	0.34	0.34	0.22	0.21	0.27	0.44	0.39
13G_2	0.09	0.13	0.10	0.10	0.10	0.40	0.28	0.16	0.25	0.24	0.46	0.45
21A_2	0.15	0.18	0.16	0.23	0.34	0.11	0.15	0.18	0.11	0.15	0.16	0.11
21B_2	0.16	0.17	0.13	0.13	0.27	0.13	0.18	0.20	0.07	0.19	0.22	0.11
21C_2	0.16	0.20	0.09	0.13	0.23	0.10	0.06	0.16	0.07	0.08	0.09	0.09
21D_2	0.19	0.17	0.18	0.15	0.29	0.21	0.20	0.25	0.08	0.12	0.20	0.11
21E_2	0.11	0.05	0.16	0.10	0.23	0.15	0.20	0.24	0.11	0.16	0.18	0.15
21F_2	0.17	0.18	0.20	0.10	0.27	0.23	0.19	0.18	0.17	0.14	0.21	0.20
21G_2	0.26	0.23	0.30	0.13	0.28	0.32	0.22	0.29	0.18	0.23	0.30	0.31
21H_2	0.27	0.25	0.18	0.19	0.29	0.16	0.22	0.21	0.14	0.16	0.21	0.24
21I_2	0.07	0.13	0.13	0.00	0.10	0.08	0.15	0.12	0.07	0.05	0.10	0.10
21L_2	0.18	0.16	0.20	0.13	0.23	0.12	0.18	0.08	0.09	0.16	0.19	0.09

Table 10, continued.

Polychoric Correlation Matrix of Items for Hispanic/Latino Students (N=209)

Item	21A_1	21B_1	21C_1	21D_1	21E_1	21F_1	21G_1	21H_1	21I_1	21L_1	13A_2	13B_2
21B_1	0.73											
21C_1	0.60	0.58										
21D_1	0.73	0.73	0.57									
21E_1	0.68	0.61	0.43	0.74								
21F_1	0.71	0.71	0.55	0.73	0.60							
21G_1	0.66	0.60	0.48	0.74	0.67	0.65						
21H_1	0.72	0.68	0.64	0.76	0.67	0.68	0.77					
21I_1	0.60	0.62	0.47	0.70	0.57	0.67	0.70	0.76				
21L_1	0.72	0.68	0.58	0.84	0.62	0.82	0.72	0.73	0.71			
13A_2	0.28	0.23	0.07	0.21	0.33	0.16	0.31	0.17	0.10	0.19		
13B_2	0.36	0.26	0.04	0.17	0.34	0.36	0.13	0.05	0.02	0.10	0.34	
13C_2	0.30	0.23	0.10	0.18	0.28	0.26	0.26	0.16	0.08	0.14	0.39	0.64
13D_2	0.13	0.19	0.03	0.03	0.22	0.10	0.21	0.15	0.03	-0.02	0.52	0.46
13E_2	0.15	0.23	0.06	0.05	0.33	0.02	0.25	0.15	-0.04	0.05	0.62	0.56
13F_2	0.13	0.13	0.02	0.13	0.21	0.15	0.16	-0.03	0.00	0.04	0.52	0.62
13G_2	0.07	0.10	0.04	0.13	0.26	0.12	0.18	0.03	0.01	-0.04	0.62	0.53
21A_2	0.36	0.30	0.34	0.34	0.30	0.30	0.26	0.39	0.19	0.22	0.16	0.18
21B_2	0.29	0.33	0.39	0.34	0.24	0.29	0.25	0.40	0.31	0.25	0.16	0.12
21C_2	0.28	0.30	0.29	0.23	0.21	0.36	0.25	0.33	0.12	0.28	0.08	0.12
21D_2	0.41	0.42	0.40	0.36	0.34	0.39	0.30	0.34	0.23	0.40	0.21	0.25
21E_2	0.32	0.28	0.42	0.33	0.33	0.30	0.22	0.35	0.18	0.27	0.18	0.20
21F_2	0.40	0.39	0.35	0.30	0.28	0.36	0.33	0.48	0.37	0.32	0.13	0.12
21G_2	0.45	0.38	0.38	0.37	0.38	0.41	0.37	0.41	0.31	0.32	0.32	0.30
21H_2	0.37	0.35	0.37	0.30	0.30	0.41	0.34	0.51	0.31	0.32	0.23	0.21
21I_2	0.30	0.24	0.36	0.21	0.26	0.32	0.18	0.43	0.24	0.24	0.05	0.03
21L_2	0.43	0.41	0.41	0.32	0.24	0.40	0.31	0.50	0.28	0.34	0.19	0.13

Table 10, continued.

Polychoric Correlation Matrix of Items for Hispanic/Latino Students (N=209)

Item	13C_2	13D_2	13E_2	13F_2	13G_2	21A_2	21B_2	21C_2	21D_2	21E_2	21F_2	21G_2	21H_2	21I_2
13D_2	0.49													
13E_2	0.55	0.65												
13F_2	0.65	0.51	0.73											
13G_2	0.51	0.56	0.74	0.85										
21A_2	0.23	0.30	0.27	0.21	0.30									
21B_2	0.21	0.31	0.25	0.21	0.24	0.88								
21C_2	0.21	0.29	0.15	0.16	0.12	0.56	0.45							
21D_2	0.34	0.40	0.27	0.28	0.34	0.80	0.83	0.62						
21E_2	0.21	0.32	0.30	0.21	0.27	0.74	0.77	0.46	0.72					
21F_2	0.32	0.49	0.28	0.23	0.24	0.74	0.73	0.54	0.79	0.78				
21G_2	0.35	0.38	0.33	0.28	0.43	0.72	0.72	0.50	0.77	0.81	0.79			
21H_2	0.29	0.41	0.35	0.25	0.31	0.83	0.78	0.58	0.75	0.76	0.93	0.77		
21I_2	0.19	0.31	0.28	0.12	0.17	0.73	0.74	0.52	0.71	0.80	0.82	0.73	0.82	
21L_2	0.23	0.32	0.21	0.17	0.17	0.72	0.77	0.53	0.74	0.69	0.83	0.66	0.86	0.75

Table 11.

Polychoric Correlation Matrix of Items for White Students (N=621)

Item	11C_1	11D_1	11E_1	11H_1	11K_1	13A_1	13B_1	13C_1	13D_1	13E_1	13F_1	13G_1
11D_1	0.67											
11E_1	0.72	0.70										
11H_1	0.69	0.61	0.65									
11K_1	0.58	0.62	0.60	0.64								
13A_1	0.26	0.35	0.31	0.37	0.33							
13B_1	0.27	0.34	0.30	0.25	0.28	0.42						
13C_1	0.24	0.32	0.34	0.29	0.26	0.49	0.62					
13D_1	0.40	0.42	0.37	0.37	0.32	0.60	0.42	0.37				
13E_1	0.41	0.50	0.43	0.39	0.36	0.59	0.46	0.46	0.66			
13F_1	0.27	0.34	0.36	0.30	0.25	0.71	0.57	0.58	0.57	0.67		
13G_1	0.34	0.36	0.37	0.40	0.34	0.77	0.53	0.53	0.62	0.70	0.88	
21A_1	0.34	0.41	0.30	0.29	0.35	0.28	0.33	0.24	0.32	0.33	0.29	0.24
21B_1	0.30	0.38	0.28	0.26	0.29	0.30	0.34	0.24	0.30	0.36	0.30	0.26
21C_1	0.15	0.21	0.12	0.13	0.16	0.07	0.17	0.07	0.07	0.06	0.09	0.12
21D_1	0.32	0.41	0.41	0.32	0.37	0.19	0.31	0.22	0.26	0.31	0.21	0.24
21E_1	0.38	0.42	0.36	0.30	0.36	0.29	0.35	0.22	0.31	0.37	0.30	0.29
21F_1	0.43	0.49	0.38	0.36	0.37	0.30	0.30	0.20	0.40	0.38	0.28	0.28
21G_1	0.41	0.50	0.43	0.40	0.38	0.37	0.36	0.31	0.34	0.46	0.38	0.36
21H_1	0.43	0.48	0.31	0.37	0.39	0.23	0.28	0.18	0.27	0.35	0.27	0.29
21I_1	0.34	0.44	0.34	0.34	0.34	0.25	0.33	0.27	0.25	0.31	0.31	0.25
21L_1	0.37	0.51	0.39	0.33	0.39	0.30	0.33	0.24	0.25	0.34	0.30	0.32
13A_2	0.17	0.16	0.15	0.21	0.15	0.48	0.28	0.30	0.32	0.32	0.46	0.52
13B_2	0.09	0.17	0.05	0.10	0.11	0.19	0.51	0.37	0.19	0.29	0.39	0.38
13C_2	0.12	0.14	0.16	0.18	0.16	0.24	0.40	0.50	0.19	0.22	0.38	0.38

Table 11, continued.

Polychoric Correlation Matrix of Items for White Students (N=621)

Item	11C_1	11D_1	11E_1	11H_1	11K_1	13A_1	13B_1	13C_1	13D_1	13E_1	13F_1	13G_1
13D_2	0.17	0.20	0.18	0.17	0.15	0.33	0.26	0.22	0.40	0.36	0.38	0.43
13E_2	0.26	0.26	0.17	0.25	0.15	0.36	0.31	0.28	0.33	0.40	0.40	0.44
13F_2	0.22	0.18	0.14	0.18	0.16	0.38	0.39	0.38	0.32	0.38	0.56	0.54
13G_2	0.26	0.18	0.17	0.22	0.19	0.43	0.34	0.35	0.34	0.38	0.57	0.59
21A_2	0.21	0.24	0.15	0.23	0.15	0.16	0.25	0.14	0.27	0.23	0.21	0.23
21B_2	0.16	0.23	0.17	0.17	0.12	0.11	0.19	0.12	0.23	0.20	0.15	0.21
21C_2	0.15	0.20	0.16	0.26	0.19	0.18	0.16	0.14	0.09	0.11	0.11	0.18
21D_2	0.22	0.27	0.23	0.22	0.21	0.16	0.24	0.13	0.24	0.24	0.20	0.21
21E_2	0.26	0.26	0.21	0.24	0.17	0.25	0.28	0.21	0.31	0.24	0.24	0.30
21F_2	0.26	0.26	0.20	0.26	0.21	0.18	0.23	0.13	0.28	0.26	0.16	0.27
21G_2	0.28	0.26	0.22	0.29	0.18	0.24	0.24	0.24	0.29	0.25	0.27	0.31
21H_2	0.24	0.27	0.20	0.25	0.15	0.13	0.18	0.07	0.20	0.17	0.13	0.22
21I_2	0.21	0.27	0.21	0.23	0.19	0.17	0.21	0.10	0.20	0.20	0.16	0.20
21L_2	0.17	0.25	0.14	0.17	0.15	0.19	0.21	0.20	0.25	0.20	0.14	0.22

Table 11, continued.

Polychoric Correlation Matrix of Items for White Students (N=621)

Item	21A_1	21B_1	21C_1	21D_1	21E_1	21F_1	21G_1	21H_1	21I_1	21L_1	13A_2	13B_2
21B_1	0.76											
21C_1	0.34	0.41										
21D_1	0.61	0.62	0.47									
21E_1	0.65	0.67	0.41	0.71								
21F_1	0.69	0.69	0.45	0.69	0.70							
21G_1	0.66	0.66	0.37	0.62	0.71	0.72						
21H_1	0.72	0.73	0.49	0.71	0.75	0.80	0.72					
21I_1	0.77	0.75	0.43	0.72	0.74	0.75	0.70	0.83				
21L_1	0.78	0.79	0.40	0.72	0.71	0.77	0.77	0.81	0.85			
13A_2	0.18	0.13	0.02	0.09	0.12	0.13	0.18	0.10	0.11	0.08		
13B_2	0.16	0.10	0.12	0.11	0.08	0.05	0.15	0.07	0.15	0.11	0.39	
13C_2	0.23	0.16	0.12	0.19	0.13	0.12	0.24	0.20	0.21	0.20	0.46	0.61
13D_2	0.19	0.14	0.10	0.14	0.11	0.19	0.14	0.18	0.15	0.13	0.57	0.46
13E_2	0.22	0.22	0.15	0.19	0.22	0.25	0.30	0.20	0.20	0.20	0.63	0.46
13F_2	0.22	0.21	0.12	0.15	0.17	0.16	0.28	0.19	0.20	0.14	0.62	0.64
13G_2	0.16	0.14	0.11	0.12	0.16	0.10	0.23	0.13	0.13	0.10	0.77	0.55
21A_2	0.36	0.35	0.10	0.27	0.32	0.30	0.24	0.31	0.36	0.36	0.30	0.28
21B_2	0.27	0.37	0.12	0.27	0.31	0.25	0.24	0.28	0.30	0.36	0.25	0.24
21C_2	0.13	0.11	0.25	0.23	0.14	0.18	0.21	0.16	0.21	0.20	0.23	0.24
21D_2	0.23	0.28	0.18	0.34	0.28	0.23	0.27	0.22	0.29	0.31	0.22	0.28
21E_2	0.28	0.31	0.16	0.27	0.37	0.32	0.33	0.31	0.34	0.34	0.29	0.30
21F_2	0.34	0.39	0.16	0.30	0.31	0.34	0.30	0.33	0.30	0.39	0.31	0.23
21G_2	0.32	0.37	0.18	0.30	0.34	0.32	0.36	0.33	0.37	0.41	0.39	0.30
21H_2	0.20	0.27	0.13	0.22	0.27	0.33	0.22	0.31	0.26	0.31	0.26	0.25
21I_2	0.26	0.33	0.12	0.29	0.33	0.29	0.29	0.33	0.32	0.41	0.24	0.22
21L_2	0.33	0.37	0.15	0.31	0.33	0.33	0.27	0.33	0.35	0.46	0.18	0.26

Table 11, continued.

Polychoric Correlation Matrix of Items for White Students (N=621)

Item	13C_2	13D_2	13E_2	13F_2	13G_2	21A_2	21B_2	21C_2	21D_2	21E_2	21F_2	21G_2	21H_2	21I_2
13D_2	0.42													
13E_2	0.44	0.66												
13F_2	0.61	0.59	0.68											
13G_2	0.52	0.63	0.71	0.87										
21A_2	0.25	0.26	0.28	0.26	0.21									
21B_2	0.24	0.27	0.24	0.23	0.19	0.91								
21C_2	0.22	0.20	0.24	0.21	0.22	0.49	0.51							
21D_2	0.24	0.30	0.26	0.30	0.26	0.74	0.76	0.61						
21E_2	0.27	0.34	0.29	0.29	0.27	0.72	0.76	0.53	0.73					
21F_2	0.29	0.30	0.28	0.24	0.23	0.79	0.76	0.50	0.71	0.76				
21G_2	0.33	0.36	0.33	0.36	0.32	0.72	0.74	0.50	0.68	0.79	0.83			
21H_2	0.25	0.32	0.29	0.29	0.24	0.77	0.75	0.57	0.74	0.77	0.84	0.78		
21I_2	0.24	0.28	0.25	0.25	0.22	0.83	0.82	0.57	0.81	0.77	0.81	0.76	0.89	
21L_2	0.28	0.25	0.21	0.20	0.19	0.79	0.85	0.52	0.74	0.75	0.81	0.75	0.79	0.85

Table 12.

Polychoric Correlation Matrix of Items for Native American Students (N=671)

Item	11C_1	11D_1	11E_1	11H_1	11K_1	13A_1	13B_1	13C_1	13D_1	13E_1	13F_1	13G_1
11D_1	0.63											
11E_1	0.62	0.67										
11H_1	0.59	0.68	0.67									
11K_1	0.61	0.64	0.61	0.63								
13A_1	0.25	0.28	0.28	0.33	0.23							
13B_1	0.28	0.18	0.17	0.20	0.19	0.43						
13C_1	0.27	0.26	0.20	0.24	0.19	0.46	0.59					
13D_1	0.30	0.36	0.33	0.31	0.34	0.61	0.46	0.33				
13E_1	0.31	0.46	0.38	0.39	0.32	0.61	0.45	0.42	0.65			
13F_1	0.28	0.34	0.30	0.29	0.27	0.69	0.51	0.55	0.60	0.63		
13G_1	0.25	0.33	0.30	0.30	0.29	0.75	0.49	0.52	0.60	0.63	0.85	
21A_1	0.32	0.41	0.30	0.31	0.31	0.31	0.27	0.28	0.23	0.34	0.24	0.22
21B_1	0.30	0.39	0.29	0.29	0.31	0.23	0.24	0.27	0.25	0.30	0.27	0.23
21C_1	0.28	0.28	0.26	0.18	0.31	0.20	0.14	0.19	0.13	0.21	0.17	0.21
21D_1	0.32	0.33	0.26	0.29	0.30	0.26	0.19	0.23	0.09	0.24	0.28	0.23
21E_1	0.36	0.36	0.34	0.32	0.34	0.31	0.30	0.24	0.33	0.42	0.36	0.35
21F_1	0.36	0.49	0.42	0.39	0.36	0.34	0.27	0.24	0.26	0.37	0.33	0.32
21G_1	0.36	0.42	0.41	0.40	0.39	0.32	0.29	0.24	0.27	0.37	0.32	0.36
21H_1	0.37	0.55	0.41	0.42	0.41	0.32	0.28	0.32	0.28	0.41	0.33	0.37
21I_1	0.40	0.45	0.31	0.36	0.32	0.27	0.27	0.27	0.21	0.39	0.31	0.33
21L_1	0.34	0.40	0.34	0.29	0.32	0.28	0.21	0.27	0.17	0.28	0.28	0.28
13A_2	0.11	0.17	0.21	0.27	0.19	0.41	0.27	0.25	0.31	0.26	0.31	0.35
13B_2	0.15	0.16	0.11	0.16	0.08	0.32	0.42	0.38	0.30	0.24	0.39	0.38
13C_2	0.13	0.20	0.16	0.20	0.16	0.28	0.34	0.40	0.23	0.22	0.29	0.35

Table 12, continued.

Polychoric Correlation Matrix of Items for Native American Students (N=671)

Item	11C_1	11D_1	11E_1	11H_1	11K_1	13A_1	13B_1	13C_1	13D_1	13E_1	13F_1	13G_1
13D_2	0.04	0.15	0.12	0.11	0.12	0.25	0.28	0.17	0.37	0.22	0.21	0.32
13E_2	0.18	0.24	0.17	0.15	0.17	0.31	0.29	0.26	0.32	0.38	0.33	0.36
13F_2	0.22	0.25	0.24	0.23	0.21	0.40	0.33	0.35	0.39	0.34	0.51	0.53
13G_2	0.15	0.20	0.21	0.26	0.16	0.40	0.32	0.28	0.36	0.33	0.41	0.51
21A_2	0.25	0.18	0.19	0.11	0.22	0.27	0.16	0.23	0.12	0.18	0.20	0.17
21B_2	0.19	0.16	0.15	0.11	0.20	0.22	0.14	0.14	0.10	0.17	0.18	0.19
21C_2	0.08	0.14	0.05	0.09	0.10	0.15	0.09	0.10	0.00	0.11	0.11	0.12
21D_2	0.16	0.17	0.15	0.19	0.21	0.26	0.14	0.22	0.13	0.15	0.23	0.21
21E_2	0.24	0.17	0.16	0.17	0.26	0.22	0.15	0.16	0.16	0.23	0.25	0.18
21F_2	0.19	0.18	0.16	0.13	0.20	0.28	0.15	0.18	0.20	0.22	0.22	0.20
21G_2	0.22	0.21	0.18	0.15	0.21	0.23	0.14	0.14	0.20	0.21	0.23	0.17
21H_2	0.19	0.18	0.13	0.12	0.18	0.27	0.16	0.12	0.14	0.21	0.21	0.19
21I_2	0.20	0.18	0.14	0.13	0.20	0.24	0.16	0.15	0.13	0.19	0.22	0.14
21L_2	0.22	0.19	0.13	0.13	0.24	0.27	0.17	0.16	0.20	0.19	0.22	0.19

Table 12, continued.

Polychoric Correlation Matrix of Items for Native American Students (N=671)

Item	21A_1	21B_1	21C_1	21D_1	21E_1	21F_1	21G_1	21H_1	21I_1	21L_1	13A_2	13B_2
21B_1	0.79											
21C_1	0.53	0.48										
21D_1	0.63	0.70	0.49									
21E_1	0.59	0.68	0.44	0.63								
21F_1	0.66	0.71	0.51	0.62	0.67							
21G_1	0.68	0.73	0.48	0.65	0.73	0.74						
21H_1	0.67	0.74	0.45	0.62	0.68	0.78	0.74					
21I_1	0.74	0.75	0.56	0.71	0.66	0.72	0.74	0.79				
21L_1	0.70	0.80	0.53	0.69	0.60	0.72	0.73	0.81	0.83			
13A_2	0.13	0.10	0.03	0.06	0.13	0.18	0.19	0.15	0.11	0.09		
13B_2	0.26	0.23	0.07	0.13	0.21	0.21	0.20	0.23	0.22	0.22	0.51	
13C_2	0.24	0.21	0.09	0.16	0.14	0.18	0.25	0.25	0.23	0.23	0.55	0.66
13D_2	0.09	0.06	0.07	0.07	0.13	0.16	0.17	0.11	0.13	0.09	0.55	0.51
13E_2	0.19	0.05	0.13	0.05	0.14	0.18	0.19	0.18	0.17	0.15	0.60	0.48
13F_2	0.15	0.12	0.07	0.17	0.22	0.21	0.23	0.17	0.16	0.12	0.71	0.62
13G_2	0.13	0.07	0.03	0.10	0.18	0.13	0.21	0.14	0.12	0.10	0.74	0.56
21A_2	0.42	0.42	0.35	0.37	0.29	0.36	0.36	0.35	0.36	0.45	0.25	0.31
21B_2	0.35	0.35	0.26	0.35	0.21	0.33	0.28	0.28	0.34	0.39	0.22	0.26
21C_2	0.29	0.24	0.24	0.32	0.14	0.21	0.20	0.18	0.29	0.31	0.11	0.16
21D_2	0.38	0.32	0.22	0.34	0.21	0.27	0.28	0.25	0.36	0.35	0.24	0.28
21E_2	0.30	0.28	0.13	0.34	0.32	0.30	0.33	0.25	0.34	0.34	0.24	0.28
21F_2	0.33	0.26	0.21	0.30	0.21	0.33	0.26	0.30	0.31	0.33	0.28	0.31
21G_2	0.38	0.33	0.29	0.35	0.30	0.33	0.34	0.30	0.34	0.35	0.31	0.31
21H_2	0.31	0.28	0.26	0.31	0.20	0.32	0.29	0.30	0.34	0.37	0.24	0.23
21I_2	0.37	0.33	0.21	0.32	0.20	0.30	0.28	0.27	0.36	0.36	0.24	0.25
21L_2	0.32	0.30	0.24	0.31	0.21	0.29	0.28	0.26	0.33	0.39	0.21	0.22

Table 12, continued.

Polychoric Correlation Matrix of Items for Native American Students (N=671)

Item	13C_2	13D_2	13E_2	13F_2	13G_2	21A_2	21B_2	21C_2	21D_2	21E_2	21F_2	21G_2	21H_2	21I_2
13D_2	0.46													
13E_2	0.42	0.63												
13F_2	0.62	0.54	0.68											
13G_2	0.58	0.60	0.68	0.86										
21A_2	0.27	0.20	0.37	0.25	0.21									
21B_2	0.26	0.16	0.34	0.30	0.22	0.84								
21C_2	0.14	0.09	0.21	0.15	0.19	0.63	0.64							
21D_2	0.23	0.19	0.30	0.26	0.23	0.76	0.77	0.61						
21E_2	0.21	0.27	0.37	0.31	0.26	0.71	0.73	0.53	0.72					
21F_2	0.21	0.30	0.39	0.32	0.28	0.76	0.79	0.61	0.76	0.80				
21G_2	0.20	0.24	0.38	0.33	0.28	0.80	0.76	0.58	0.79	0.78	0.85			
21H_2	0.15	0.26	0.37	0.24	0.24	0.80	0.80	0.64	0.77	0.75	0.89	0.83		
21I_2	0.19	0.18	0.34	0.31	0.24	0.75	0.78	0.56	0.77	0.76	0.80	0.84	0.82	
21L_2	0.22	0.25	0.36	0.28	0.22	0.74	0.80	0.61	0.78	0.78	0.79	0.79	0.81	0.82

APPENDIX C:
SUPPLEMENTAL ANALYSIS COMPARING EFFECTS OF THE MEASUREMENT INVARIANCE MODEL AND THE PARTIAL MEASUREMENT INVARIANCE MODEL ON LATENT FACTOR MEANS

When conducting studies of measurement invariance, a critical decision must be made regarding how to best handle noninvariant measures. Sass (2011) describes several options available to researchers confronting this scenario. Of these options, one common approach for handling noninvariant measures is to employ a partial measurement invariance model (PMI; Byrne, 2012) in which only the invariant items are constrained across groups. In PMI models, noninvariant items are not constrained and are therefore allowed to vary across groups.

The PMI approach is beneficial in that it allows further tests of invariance to continue if desired (e.g., tests of structural invariance) and it allows for the continued use of all items in the scale, albeit with items modeled in a group-specific manner as dictated by the source of the noninvariance. However, the PMI approach can be problematic: the presence of noninvariance indicates that the measure is operating differently across groups, and as such, groups' scores are not perfectly comparable. Researchers (e.g., Byrne, 2012) have suggested that the effect of noninvariance on groups' latent factor means should be minimal if the extent of the noninvariance is relatively small; that is, if the number of noninvariant items is small compared to the overall number of items. However, researchers conducting studies of measurement invariance are encouraged to examine the statistical and practical impact of various models (e.g., PMI vs. MI) on group latent factor means (Chen, 2008; Sass, 2011). In cases when the effect of noninvariance on group means is trivial, use of the more parsimonious model (i.e., the full measurement invariance model) is generally recommended (Sass, 2011).

In the current study, three of the five latent factors showed signs of noninvariance (i.e., one or more loadings or thresholds were not invariant across the four groups): *Optimism2*, *Engagement1*, and *Engagement2*. As recommended in the current literature (Chen, 2008; Sass (2011), latent factor mean differences between groups were compared using the full invariance model and the partial invariance model to assess the impact of noninvariant items and to determine which model (i.e., MI or PMI) should be used in further analyses. The primary question answered by the comparison is: "Do conclusions about mean level differences between groups vary based on whether the MI or the PMI model is used?". This analysis was conducted for each factor by setting the latent factor mean for one group (African American) equal to zero and estimating the means of the other three groups.

Whether the choice of model would substantially influence the conclusions was determined based on two considerations: (a) whether the models resulted in the same decision regarding rejecting or failing to reject the null hypothesis of no latent factor mean difference between groups, and (b) the magnitude of any changes in the effect size related to group differences (Sass, 2011). Cohen's *d* effect size (Cohen, 1988) was used in this analysis and was calculated using the following equation: $d = 2t / \sqrt{df}$, using the *t*-statistics provided in the Mplus output (Sass, 2011). Although no general consensus exists on interpreting the magnitude of effect sizes (Dunst, Hamby, & Trivette, 2004), Cohen (1988) established guidelines that are useful in interpreting the results of this analysis. According to Cohen's cutoffs, effect sizes of .20, .50, and .80 can be interpreted as small, medium, and large, respectively. In addition to Cohen's standards, effect sizes less than the .20 threshold can be considered a very small effect (Powers, Bowen, Webber, & Bowen, 2011).

Results of these analyses for each of the three latent factors are shown in Table 13 and presented in the following sections. Detailed results are first presented for the *Optimism2* latent variable. Because the process of analysis is similar for each variable, less detail is provided in the narrative for the remaining two factors.

Optimism2 Latent Variable

Analysis revealed that the *Optimism2* latent factor mean for African American students was significantly higher than the mean of each of the other three racial/ethnic groups, regardless of whether the MI model or the PMI model was estimated. For example, the mean for Hispanic/Latino students was lower than African American students by 0.85 units (p=.000) and 0.88 units (p=.000) for the MI and PMI models, respectively. For each group comparison, both the MI and the PMI model would lead to same conclusion: reject the null hypothesis of no latent factor mean difference between the groups.

Likewise, the changes in the effect sizes were minor: differences in Cohen's *d* between the MI and PMI models ranged from 0.01 to 0.11. In each comparison of group means, the magnitude of the effect sizes from the two models would be interpreted the same. For example, in the comparison of means for African American and Hispanic/Latino students, the effect sizes from each model (MI=0.61; PMI=0.62) would be interpreted as medium effects using Cohen's guidelines. Similarly, both effect sizes from the comparison of means for African American and Native American students (MI=0.25; PMI=0.29) would be considered small effects. One potential difference arises in the comparison of means for African American and White students. Using the most strict interpretation of Cohen's guidelines (i.e., effect size of .20 to .49 = small and .50 to .79=medium), the Cohen's *d* from the MI model (d=0.46) would be considered a small effect, while the Cohen's *d* from the PMI model (d=.57) would be considered a medium effect. However, is it important to remember than effect size guidelines are not intended to be strict cut-

offs. Given the negligible difference (i.e., .04) between the MI effect size and the bottom "cutoff value" for a medium effect, the effect size for the MI model and the PMI model are judged to be consistent from a practical point of view for purposes of this study.

Overall, these findings indicate that failure to model group-level measurement differences for this latent factor would not drastically influence the conclusions regarding whether the latent factor means for *Optimism2* differed across the race/ethnicity groups. Based on these findings, the more parsimonious MI model can be modeled in further analyses without unduly influencing study results and conclusions (Sass, 2011).

Engagement1 Latent Variable

For the *Engagement1* factor, whether a MI or PMI model is estimated would not influence the conclusions regarding latent mean differences between the groups. Both models indicate that the latent factor mean for African American students was: (a) significantly lower than the means for Hispanic/Latino and White students and (b) not significantly different from the mean for Native American students. Likewise, there were no difference in the magnitude of effect sizes and any actual differences in the effect sizes across models were minor: differences in Cohen's *d* between the MI and PMI models ranged from 0.01 to 0.04. Based on these findings, the more parsimonious MI model can be modeled in further analyses without unduly influencing study results and conclusions (Sass, 2011).

Engagement2 Latent Variable

For the *Engagement2* factor, whether a MI or PMI model is estimated would not influence the conclusions regarding latent mean differences between the groups. Both models indicate that the latent factor mean for African American students was: (a) significantly lower than the mean for Hispanic/Latino and (b) not significantly different from the means for White

and Native American students. Likewise, there were no difference in the magnitude of effect sizes and any actual differences in the effect sizes across models were minor: differences in Cohen's *d* between the MI and PMI models ranged from 0.00 to 0.07. Based on these findings, the more parsimonious MI model can be modeled in further analyses without unduly influencing study results and conclusions (Sass, 2011).

Table 13.

Mean Comparisons Using the MI and PMI Models for the Optimism2, Engagement1, and Engagement 2 Latent Factors

Factor	Model	Group	M_{Diff}	*t*-statistic	*p* value	Cohen's *d*
Optimism2	MI	Hispanic/Latino	-0.85	-4.40	.000	-0.61
		White	-0.82	-5.74	.000	-0.46
		Native American	-0.54	-3.29	.001	-0.25
	PMI	Hispanic/Latino	-0.88	-4.49	.000	-0.62
		White	-1.01	-7.12	.000	-0.57
		Native American	-0.63	-3.75	.000	-0.29
Engagement1	MI	Hispanic/Latino	0.28	2.92	.003	0.41
		White	0.33	3.03	.002	0.24
		Native American	0.24	1.65	.098	0.13
	PMI	Hispanic/Latino	0.28	2.87	.004	0.40
		White	0.28	2.47	.014	0.20
		Native American	0.27	1.81	.070	0.14
Engagement2	MI	Hispanic/Latino	0.28	1.99	.046	0.28
		White	0.21	1.19	.236	0.09
		Native American	0.16	0.95	.340	0.07
	PMI	Hispanic/Latino	0.29	2.02	.043	0.28
		White	0.05	0.28	.776	0.02
		Native American	0.07	0.45	.656	0.03

Note: MI = measurement invariance; PMI = partial measurement invariance

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